

**NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS**

REPORT No. 628

**AERODYNAMIC CHARACTERISTICS
OF A LARGE NUMBER OF AIRFOILS TESTED IN THE
VARIABLE-DENSITY WIND TUNNEL**

By ROBERT M. PINKERTON and HARRY GREENBERG



1938

AERONAUTIC SYMBOLS

I. FUNDAMENTAL AND DERIVED UNITS

	Symbol	Metric		English	
		Unit	Abbrevia- tion	Unit	Abbrevia- tion
Length	l	meter	m	foot (or mile)	ft. (or mi.)
Time	t	second	s	second (or hour)	sec. (or hr.)
Force	F	weight of 1 kilogram	kg	weight of 1 pound	lb.
Power	P	horsepower (metric)		horsepower	hp.
Speed	v	kilometers per hour	k.p.h.	miles per hour	m.p.h.
		meters per second	m.p.s.	feet per second	f.p.s.

II. GENERAL SYMBOLS

- W , Weight— mg
 g , Standard acceleration of gravity—9.80665 m/sec² or 32.1740 ft./sec.²
 m , Mass— $\frac{W}{g}$
 I , Moment of inertia— ml^2 (Indicate axis of radius of gyration k by proper subscript)
 μ , Coefficient of viscosity
 ν , Kinematic viscosity
 ρ , Density (mass per unit volume)
 Standard density of dry air, 0.12497 kg-m⁻³ at 15° C. and 760 mm; or 0.002378 lb.-ft.⁻³ sec.
 Specific weight of "standard" air, 1.2255 kg/m³ or 0.07651 lb./cu. ft.

III. AERODYNAMIC SYMBOLS

- S , Area
 S_w , Area of wing
 G , Gap
 b , Span
 c , Chord
 λ , Aspect ratio
 V , True air speed
 q , Dynamic pressure— $\frac{1}{2}\rho V^2$
 L , Lift, absolute coefficient $C_L = \frac{L}{qS}$
 D , Drag, absolute coefficient $C_D = \frac{D}{qS}$
 D_p , Profile drag, absolute coefficient $C_{Dp} = \frac{D_p}{qS}$
 D_u , Induced drag, absolute coefficient $C_{Du} = \frac{D_u}{qS}$
 D_f , Parasite drag, absolute coefficient $C_{Df} = \frac{D_f}{qS}$
 C , Cross-wind force, absolute coefficient $C_C = \frac{C}{qS}$
 R , Resultant force
 α , Angle of setting of wings (relative to thrust line)
 β , Angle of stabilizer setting (relative to thrust line)
 M , Resultant moment
 ω , Resultant angular velocity
 Re , Reynolds Number, where l is a linear dimension (e.g., for a model airfoil 3 in. chord, 100 m.p.h. dynamic pressure at 15° C., the corresponding number is 234,000; or for a model of 10 cm chord, 40 m.p.h., the corresponding number is 274,000)
 x , Center-of-pressure coefficient (ratio of distance of c.p. from leading edge to chord length)
 α , Angle of attack
 α_d , Angle of downwash
 α_∞ , Angle of attack, infinite aspect ratio
 α_i , Angle of attack, induced
 α_a , Angle of attack, absolute (measured from zero-lift position)
 γ , Flight-path angle

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Langley Memorial Aeronautical Laboratory**

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SUMMARY

The aerodynamic characteristics of a large number of miscellaneous airfoils tested in the variable-density tunnel have been reduced to a comparable form and are published in this report for convenient reference. Plots of the standard characteristics are given for each airfoil and, in addition, the important characteristics are given in tabular form. Included also is a tabulation of important characteristics for the related airfoils reported in N. A. C. A. Report No. 460.

This report, in conjunction with N. A. C. A. Report No. 610, makes available in comparable and convenient form the aerodynamic data for airfoils tested in the variable-density tunnel since January 1, 1931.

INTRODUCTION

A large number of miscellaneous airfoils not included in the systematic investigations reported in references 1 and 2 have been tested in the variable-density tunnel. The larger part of these airfoils consists of unrelated sections, tests of which were requested by various agencies; and the results, except those published in reference 3, have not heretofore been available in published form. The rest of the airfoils consist of small groups of related sections tested to study the effects of certain local variations in shape.

One of these local shape variations involved changes of the nose shape, consisting primarily of changes of the leading-edge radius. The effects of these changes were determined by tests of modifications of the Göttingen 398 (reference 4), of the Clark Y (reference 5), and of the N. A. C. A. 2412 (unpublished). References 4 and 5 present data on the effect of sharp leading edges. The modifications to the N. A. C. A. 2412 consisted in varying the leading-edge radius from normal to zero (N. A. C. A. 2412, N. A. C. A. 15, 16, 19, and 20) and in dropping the leading edge from the normal position (N. A. C. A. 17 and 18). A second local shape variation involved the rear portion of the airfoil and consisted in reflexing the mean line. Such modifications were made on the Göttingen 398, the Boeing 106, and the N-60 sections, and the results of the tests were published in reference 6. A series of related forward-

camber airfoils having reflexed mean lines was tested, and the results were published in reference 7. Another series of reflexed airfoils, for which the results have not been published, includes the N. A. C. A. 21, 23, 24, 25, 26, and 27 airfoils.

The results of these tests, including both published and unpublished data, have not heretofore been available in comparable form nor convenient for ready reference by the user. It has therefore been deemed desirable to collect these data into one report.

This report, in conjunction with reference 2, makes available, in convenient form, comparable data for sections tested in the variable-density tunnel since January 1, 1931. The important fully corrected characteristics for the miscellaneous sections described earlier and also for the sections reported in reference 1 are tabulated for easy reference. In addition to the tabulated data, plots of standard aerodynamic characteristics are presented for the miscellaneous airfoils.

TESTS AND APPARATUS

Routine airfoil tests were made in the variable-density tunnel at an effective Reynolds Number of approximately 8,000,000. Tests of some of the models were extended through the range of negative angles of attack. Airfoils for which these results were obtained are designated "inverted" sections. The duralumin models were of rectangular plan form with a 5-inch chord and a 30-inch span. A description of the tunnel, the test procedure, and the method of constructing the models is given in reference 8.

The precision of the tests and of the results is discussed in references 1 and 9.

RESULTS

The method chosen to present these results is intended to be convenient for designers. The important characteristics, fully corrected as described in references 9 and 10, are presented in tables I and II and are comparable with those given in reference 2. These important characteristics are:

- $c_{l_{max}}$, the section maximum lift coefficient.
- α_0 , the angle of zero lift.

- a_0 , the section lift-curve slope.
- $c_{l_{opt}}$, the optimum lift coefficient, or the section lift coefficient corresponding to $c_{d_{0min}}$.
- $c_{d_{0min}}$, the minimum profile-drag coefficient.
- $c_{m_{a.c.}}$, the pitching-moment coefficient about the section aerodynamic center.
- $a.c.$, the aerodynamic center, or the point, with respect to the airfoil section, about which the pitching-moment coefficient tends to remain constant over the range of lift coefficients between zero and maximum lift.
- $c.p.$, the position of the center of pressure in percentage of the chord behind the leading edge.
- m_0 , the lift-curve slope for aspect ratio 6.

A more complete description of these characteristics is presented in references 9 and 10.

Tables I and II contain these data for available sections tested in the variable-density tunnel, except those given in reference 2. Reference is made to the original publication for the airfoil results that have been previously reported.

Plots of the standard characteristics (figs. 1 to 88) are given for the miscellaneous sections (exclusive of those for the N. A. C. A. 22112, 23112, 24112, and 25112 sections, which are published in reference 7) because they are not available elsewhere. Plots for the sections in table I are given in reference 1.

LANGLEY MEMORIAL AERONAUTICAL LABORATORY,
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS,
LANGLEY FIELD, VA., October 1, 1937.

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1. Jacobs, Eastman N., Ward, Kenneth E., and Pinkerton, Robert M.: The Characteristics of 73 Related Airfoil Sections from Tests in the Variable-Density Wind Tunnel. T. R. No. 460, N. A. C. A., 1933.
2. Jacobs, Eastman N., Pinkerton, Robert M., and Greenberg, Harry: Tests of Related Forward-Camber Airfoils in the Variable-Density Wind Tunnel. T. R. No. 610, N. A. C. A., 1937.
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4. Jacobs, Eastman N.: Characteristics of Two Sharp-Nosed Airfoils Having Reduced Spinning Tendencies. T. N. No. 416, N. A. C. A., 1932.
5. Weick, Fred E., and Seudder, Nathan F.: The Effect on Lift, Drag, and Spinning Characteristics of Sharp Leading Edges on Airplane Wings. T. N. No. 447, N. A. C. A., 1933.
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9. Jacobs, Eastman N., and Sherman, Albert: Airfoil Section Characteristics as Affected by Variations of the Reynolds Number. T. R. No. 586, N. A. C. A., 1937.
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CHARACTERISTICS OF AIRFOILS TESTED IN THE VARIABLE-DENSITY TUNNEL

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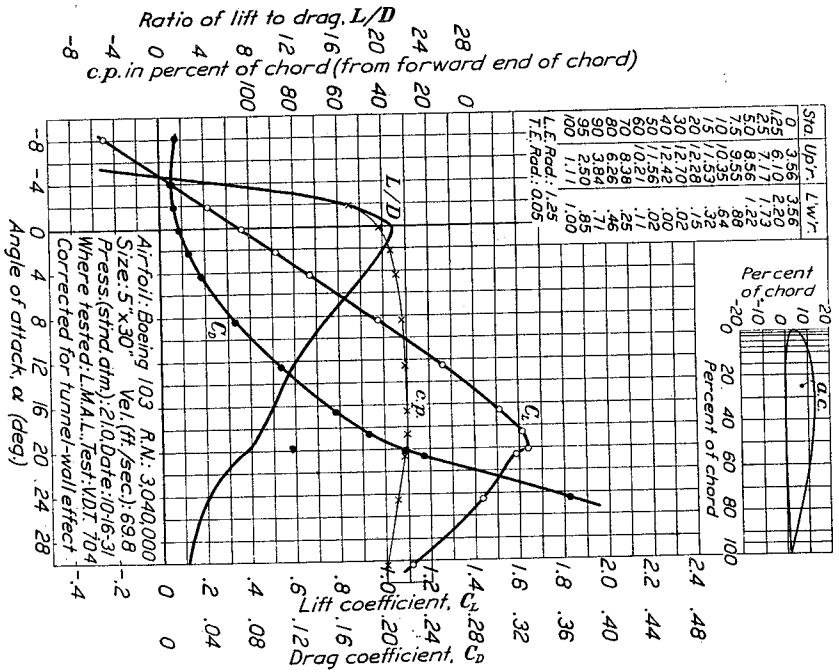


FIGURE 1.—Boeing 103 airfoil.

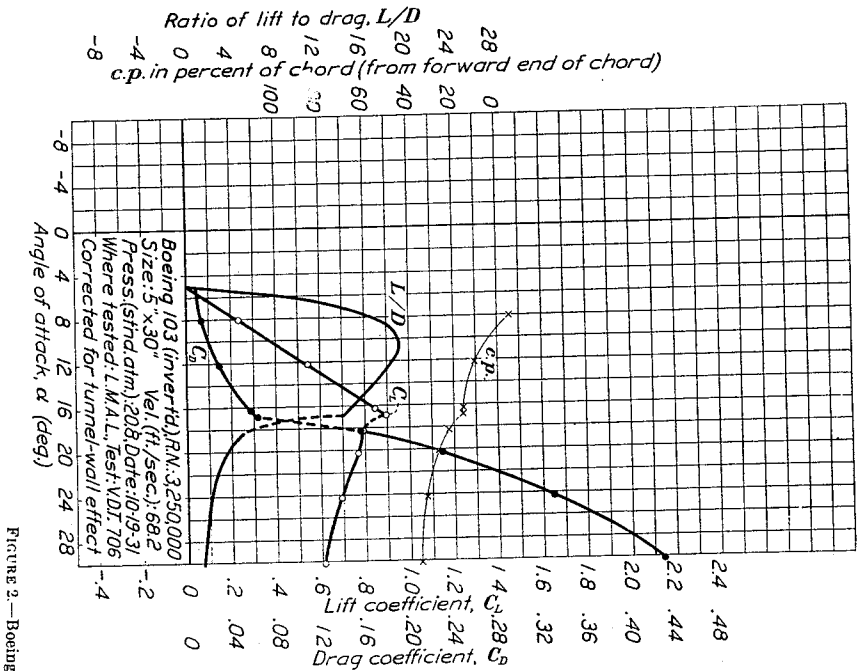
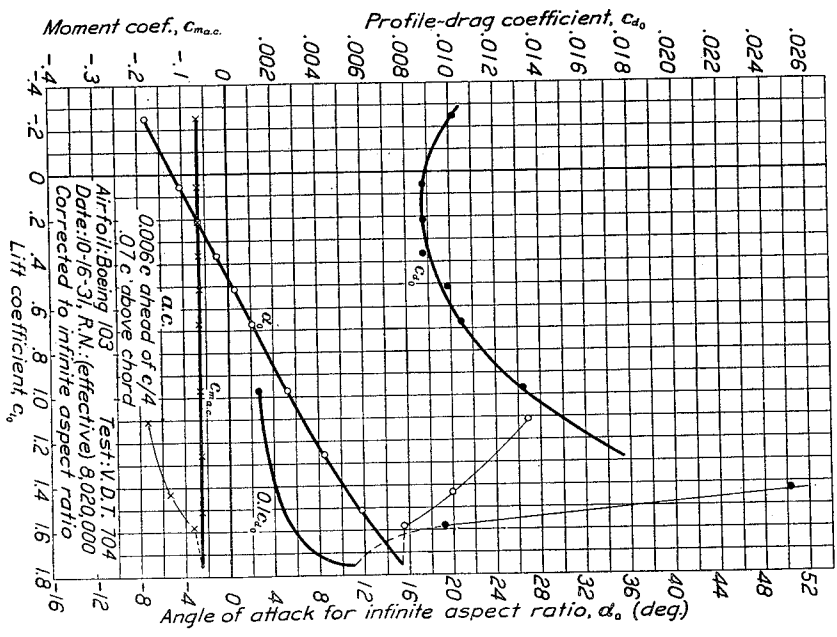
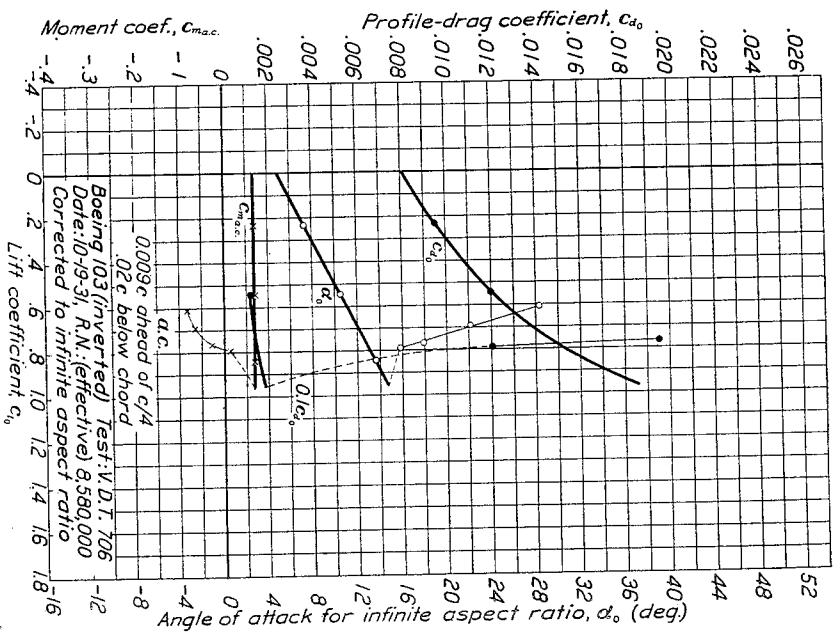


FIGURE 2.—Boeing 103 airfoil (inverted).



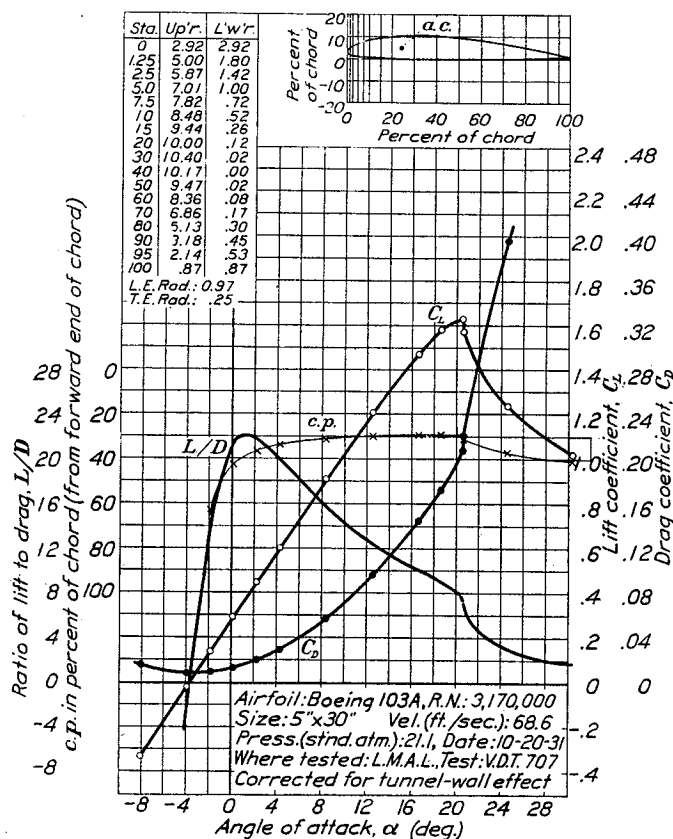


FIGURE 3.—Boeing 103 A airfoil.

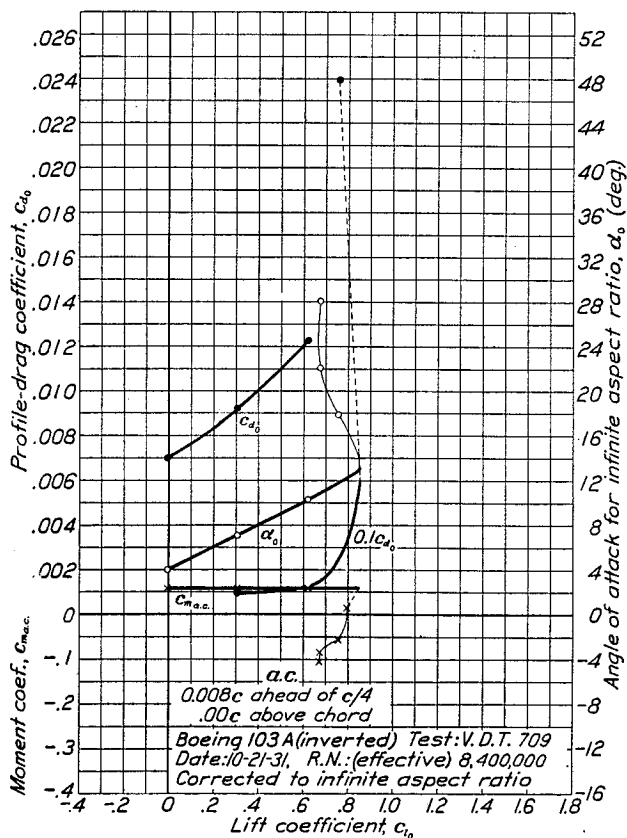
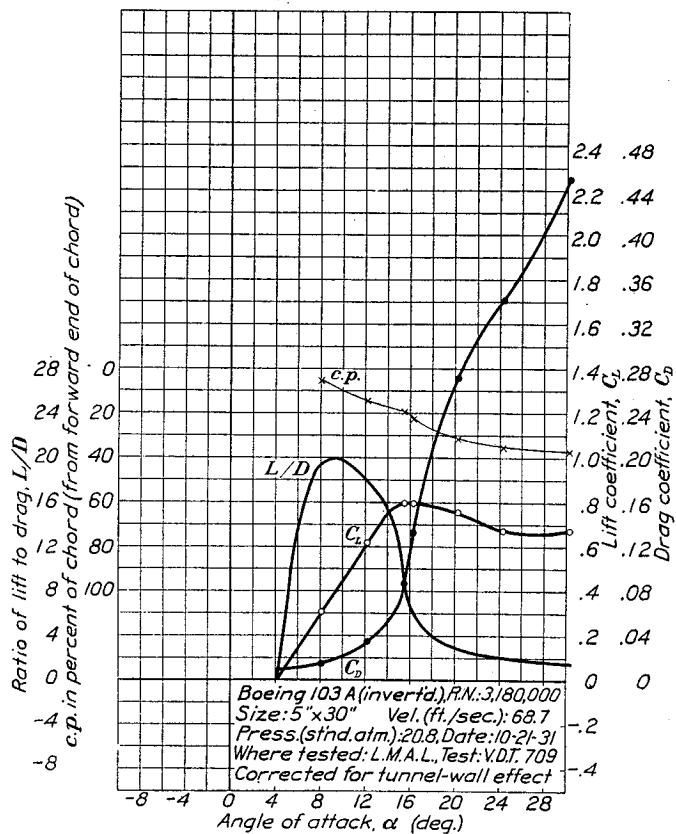
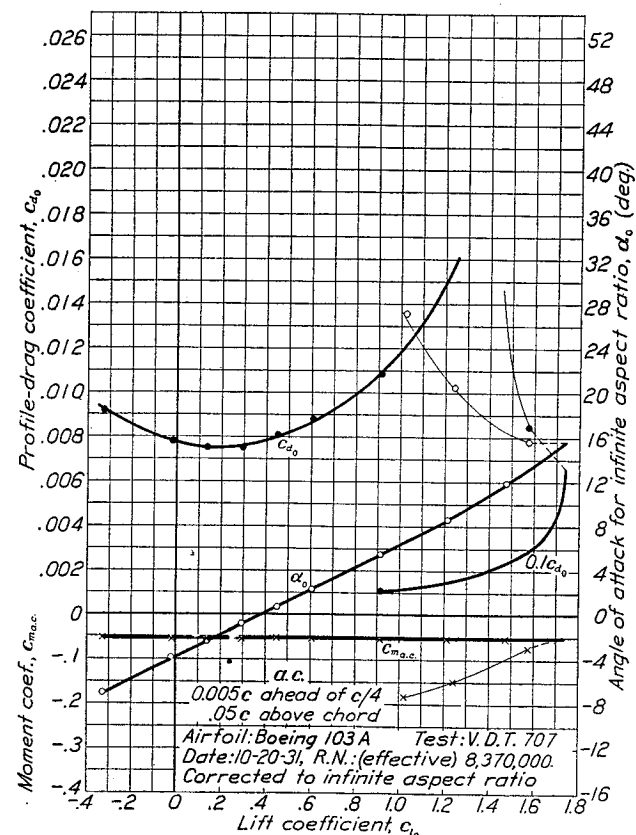


FIGURE 4.—Boeing 103 A airfoil (inverted).

CHARACTERISTICS OF AIRFOILS TESTED IN THE VARIABLE-DENSITY TUNNEL

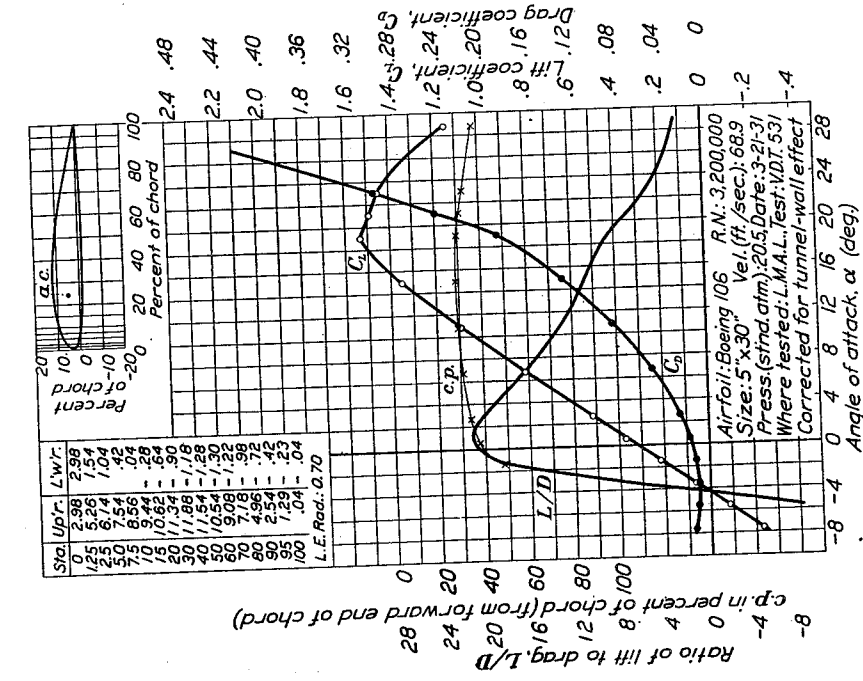


FIGURE 5.—Boeing 106 airfoil.

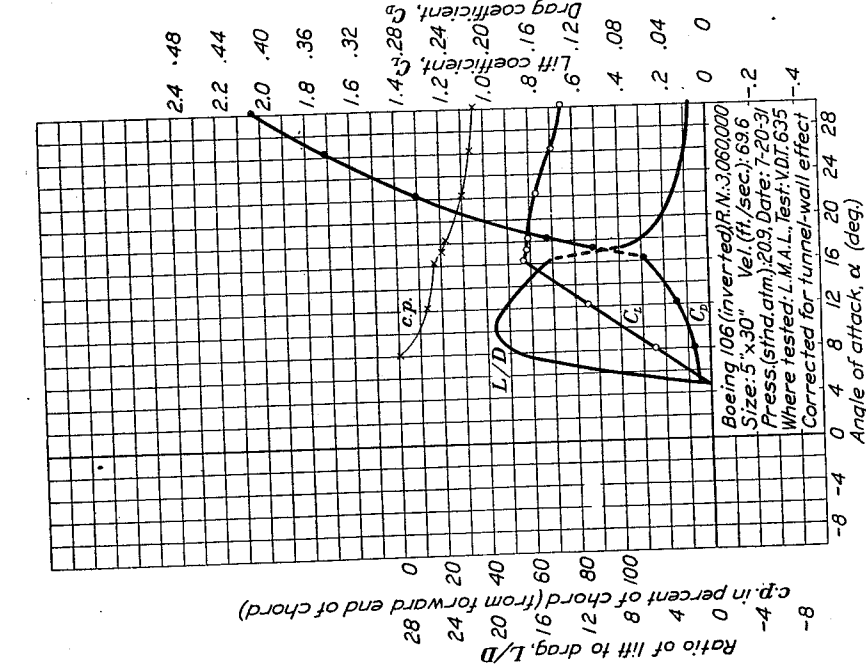
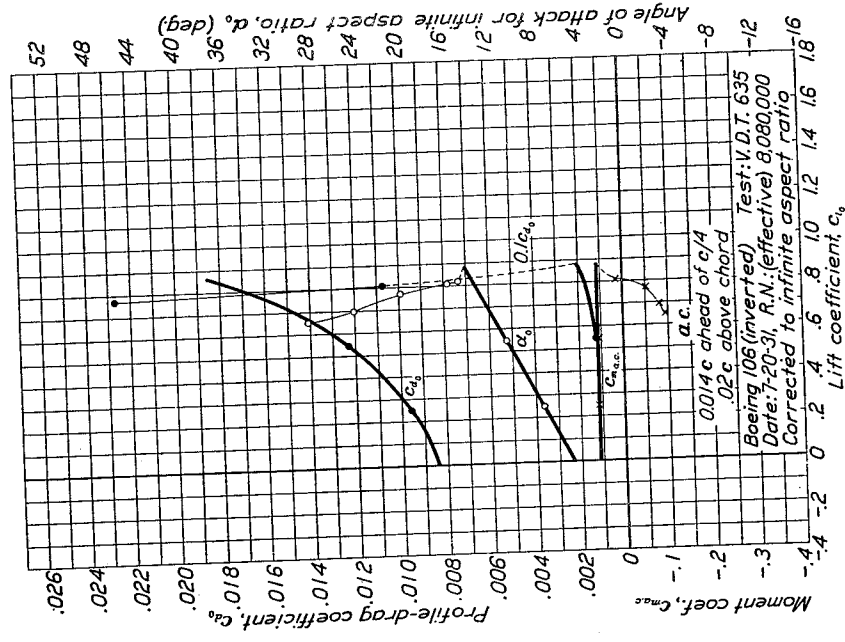
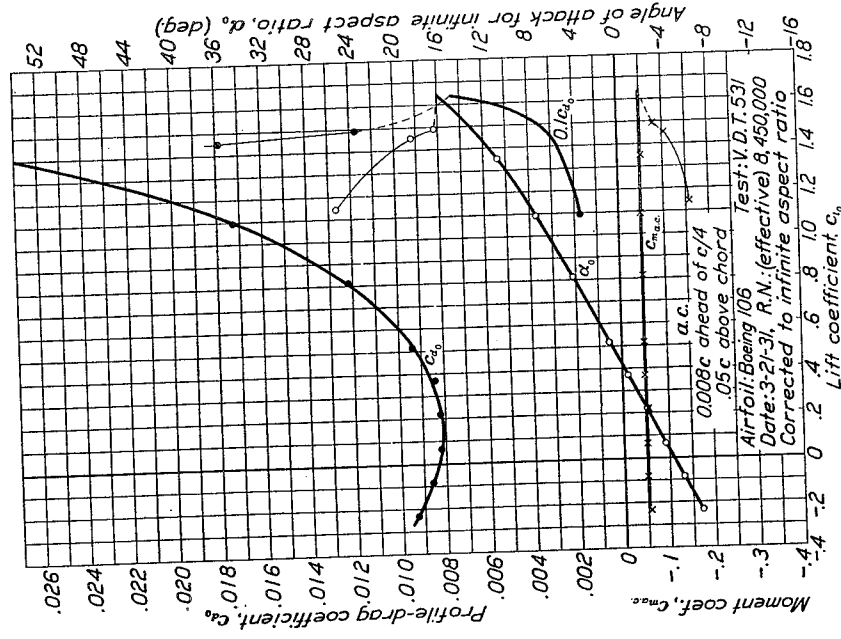


FIGURE 6.—Boeing 106 airfoil (inverted).



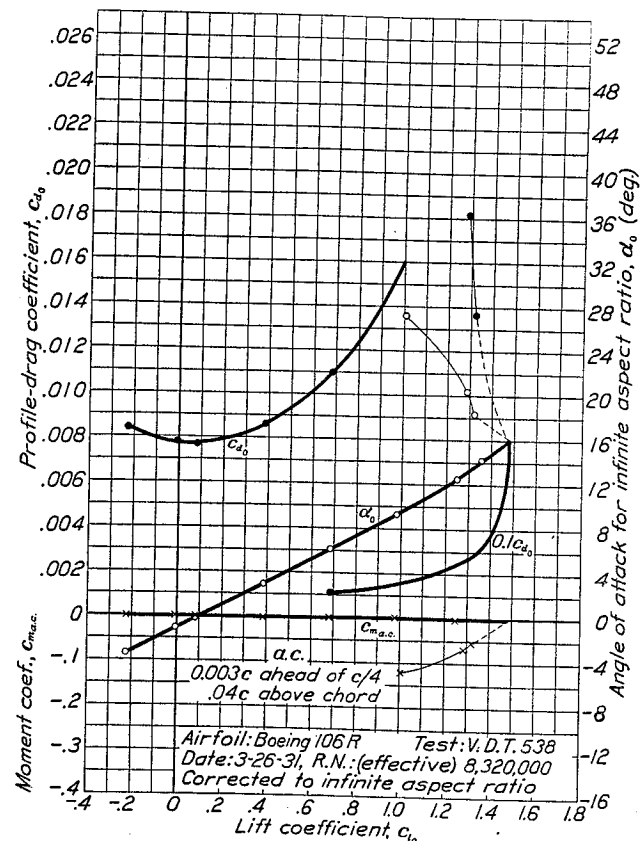
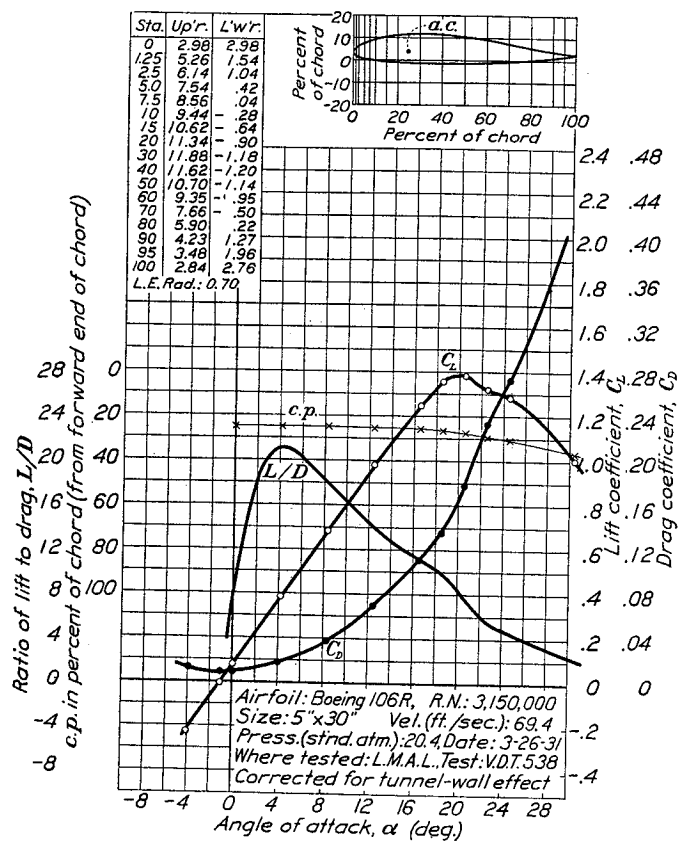


FIGURE 7.—Boeing 106 R airfoil.

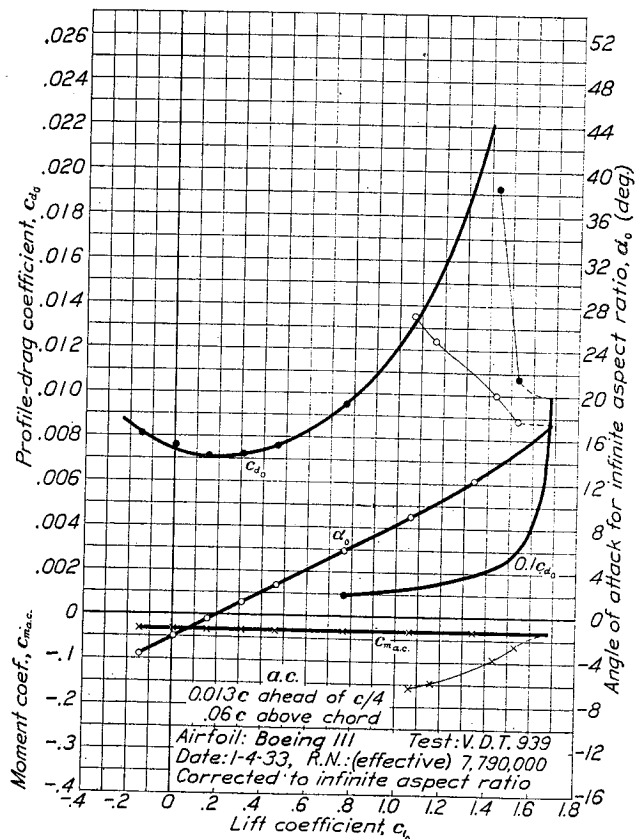
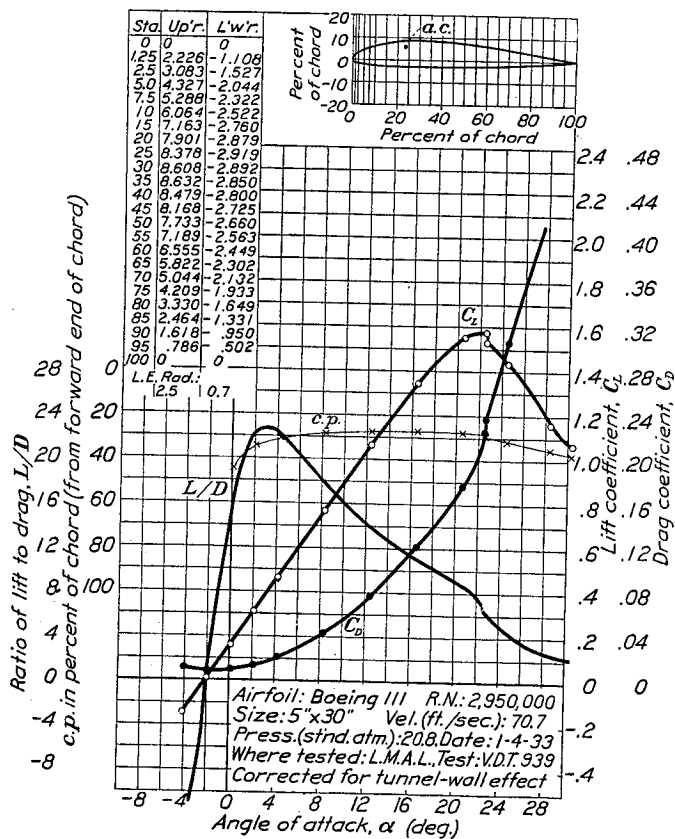


FIGURE 8.—Boeing 111 airfoil.

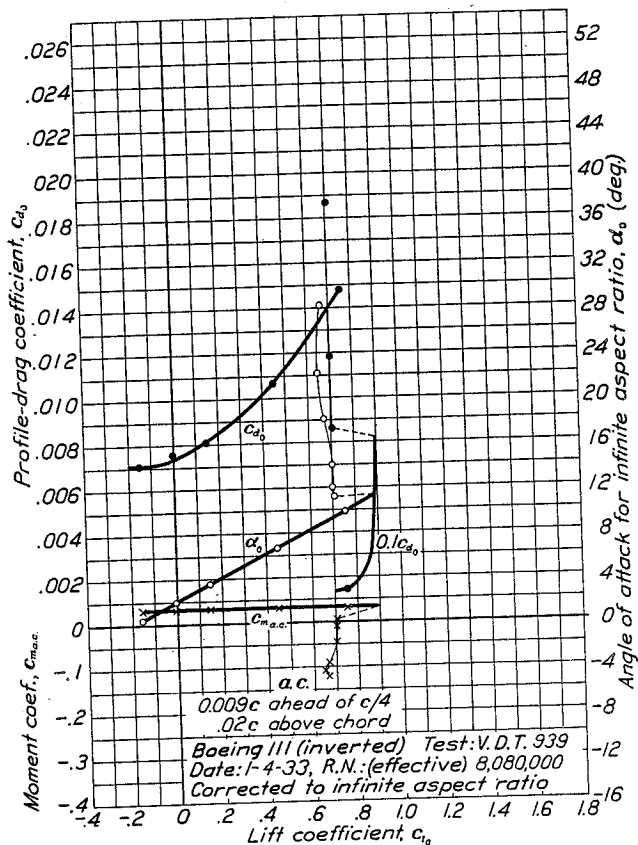
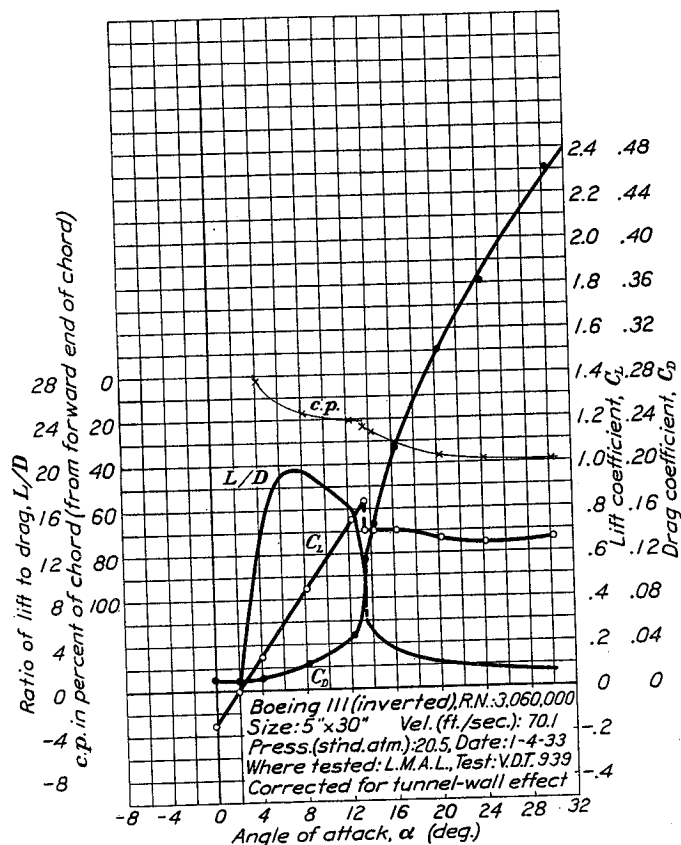


FIGURE 9.—Boeing 111 airfoil (inverted).

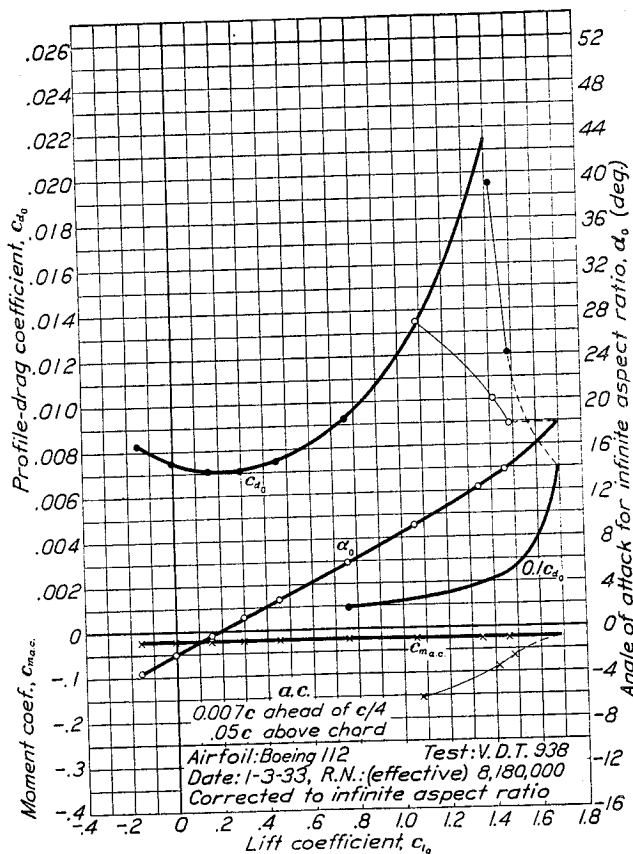
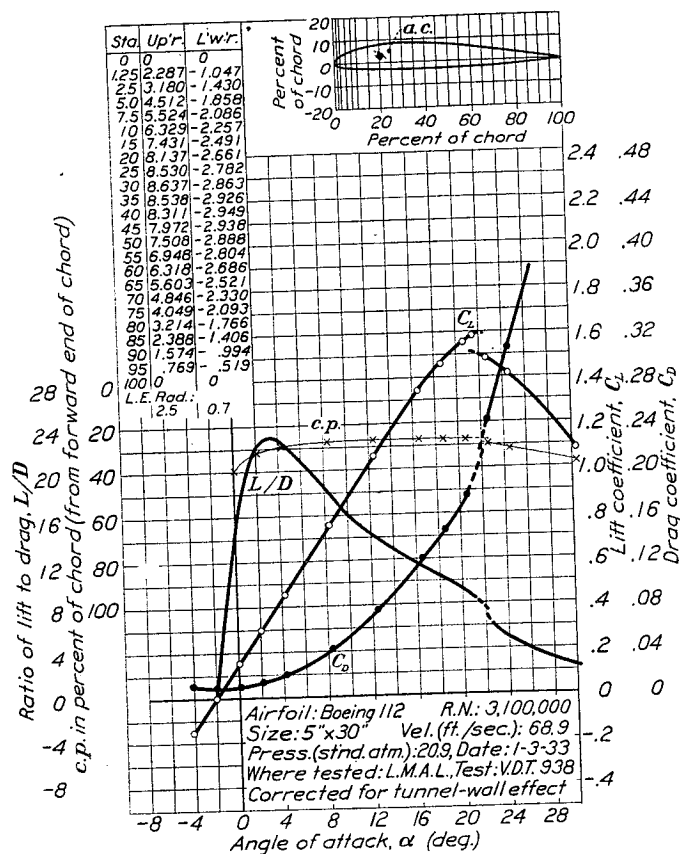


FIGURE 10.—Boeing 112 airfoil.

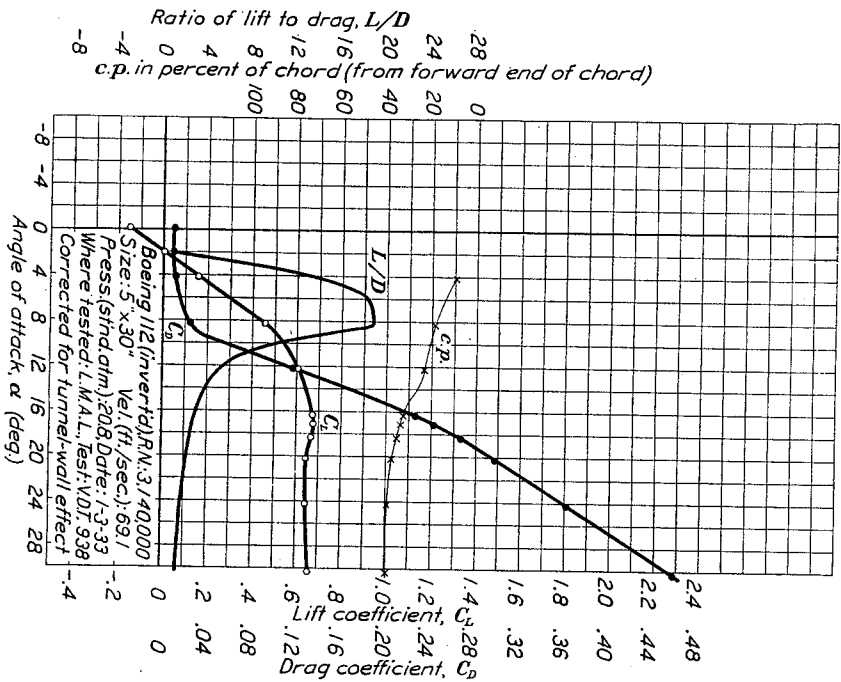


FIGURE 11.—Boeing 112 airfoil (inverted).

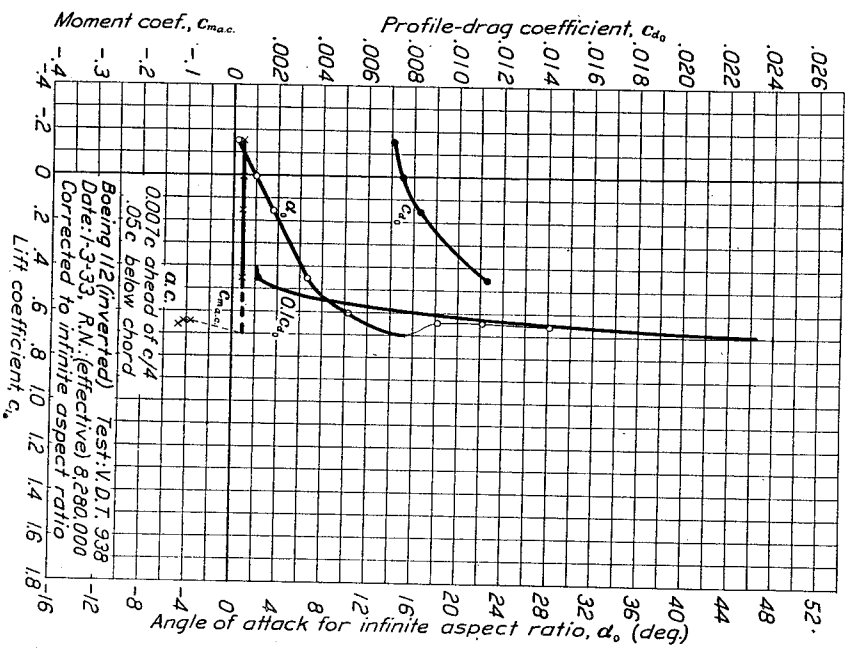
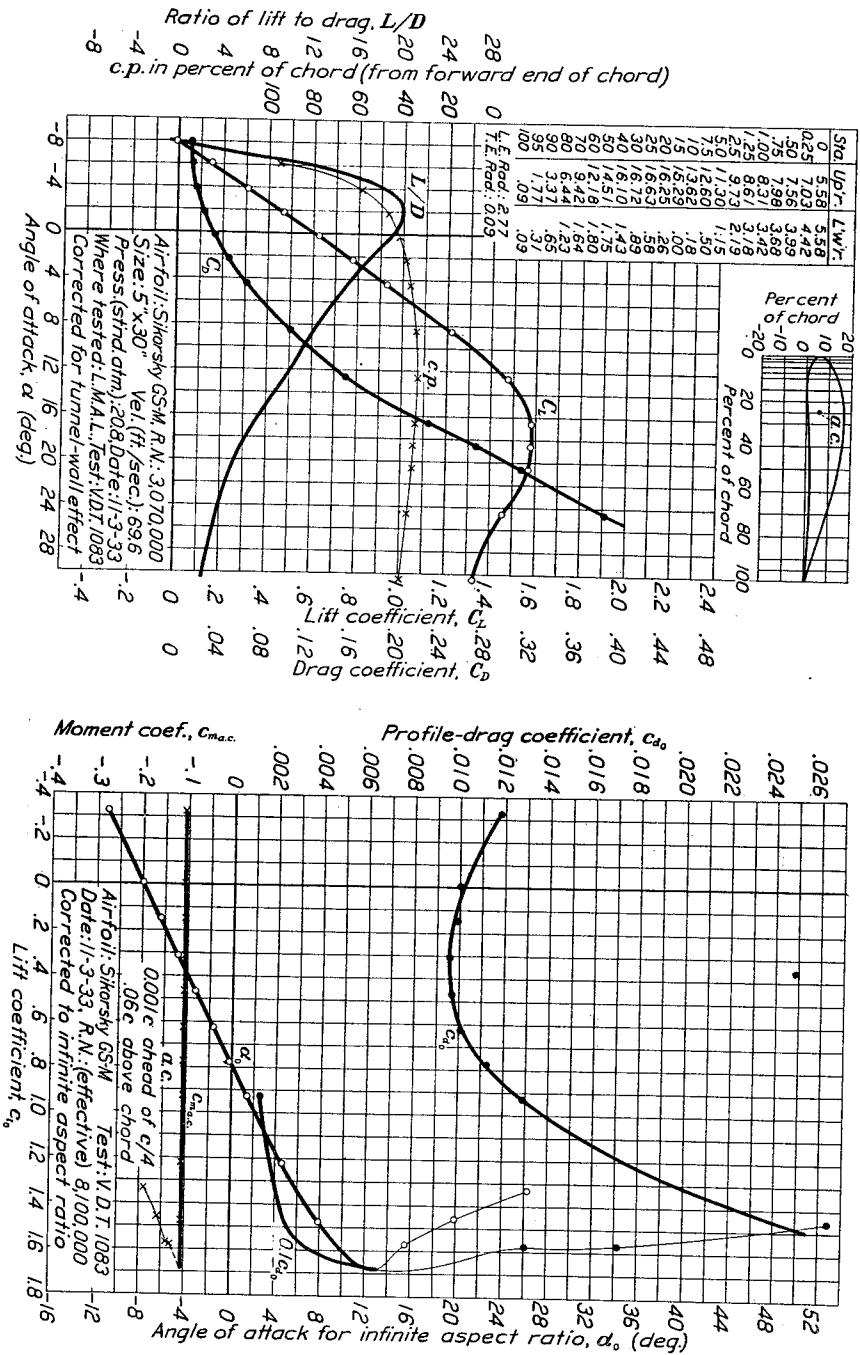


FIGURE 12.—Sikorsky GS-M airfoil.



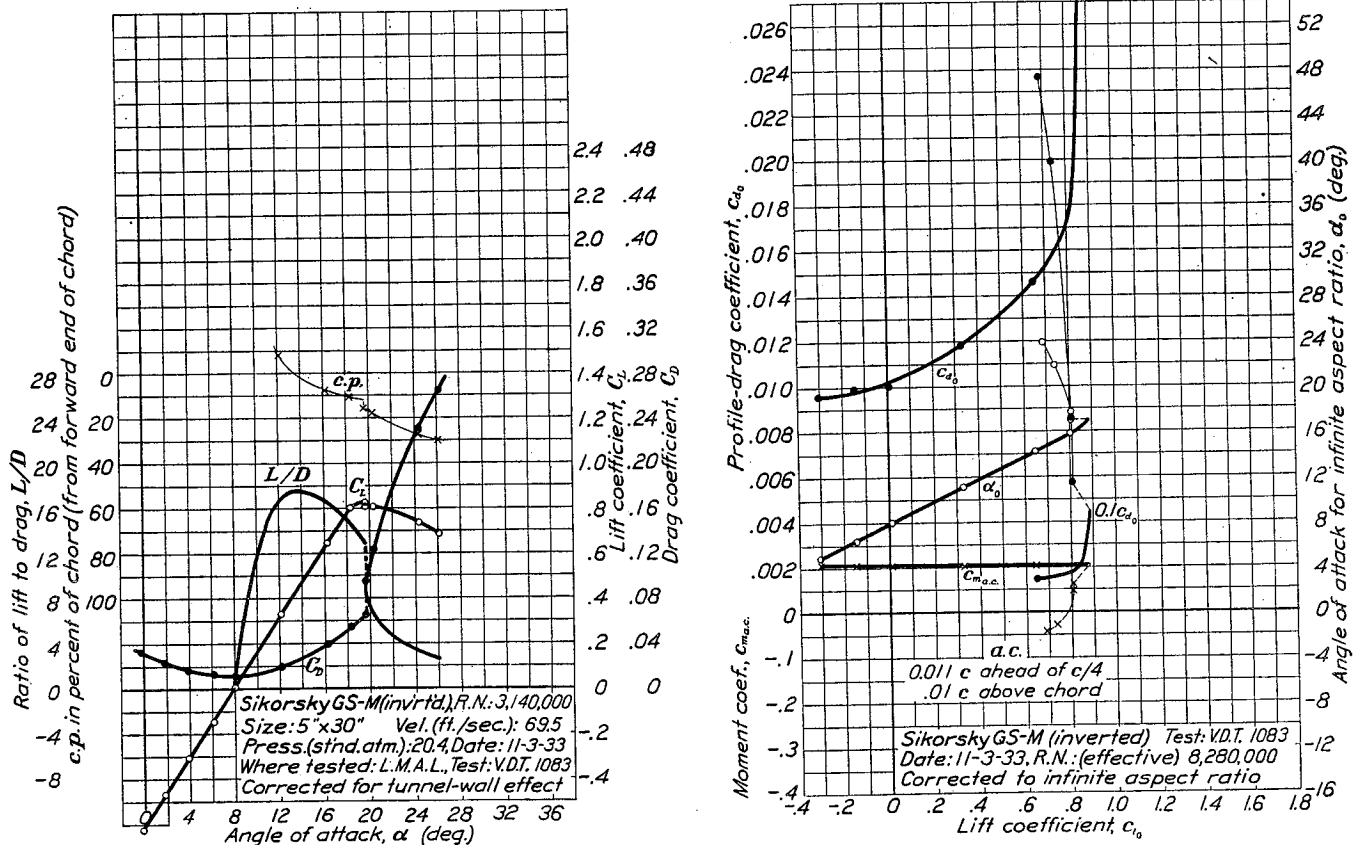


FIGURE 13.—Sikorsky GS-M airfoil (inverted).

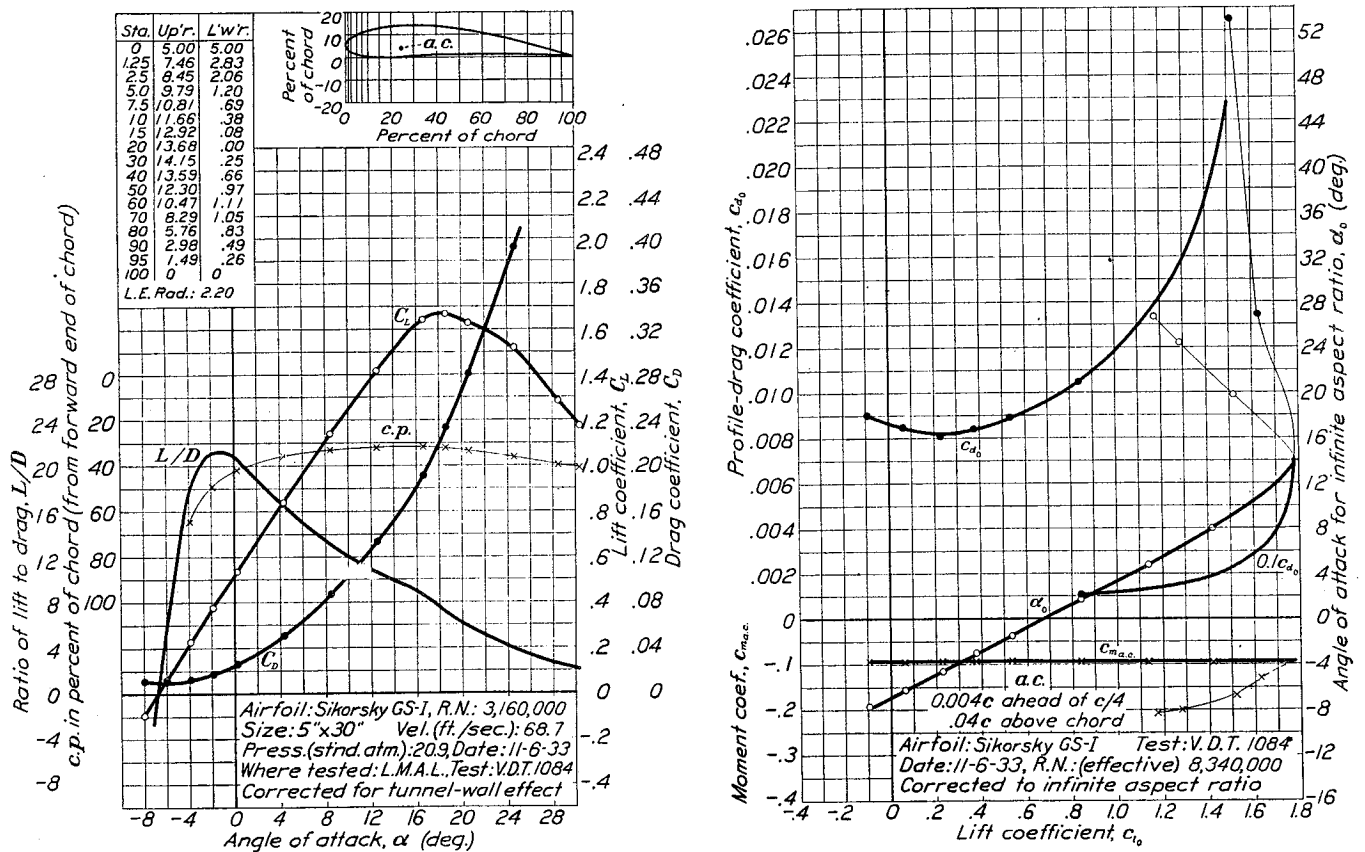


FIGURE 14.—Sikorsky GS-I airfoil.

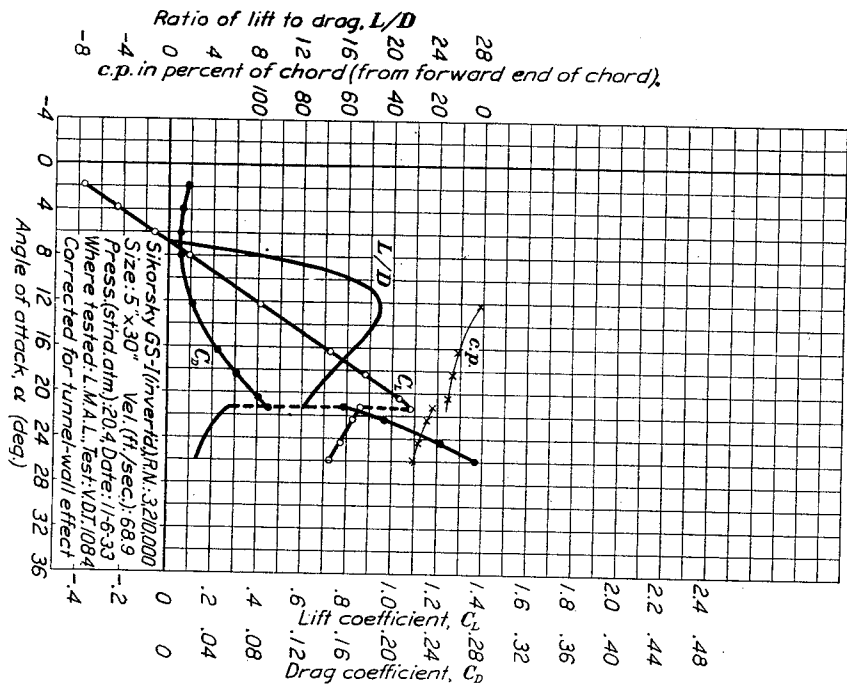


Figure 15.—Sikorsky GS-1 airfoil (inverted).

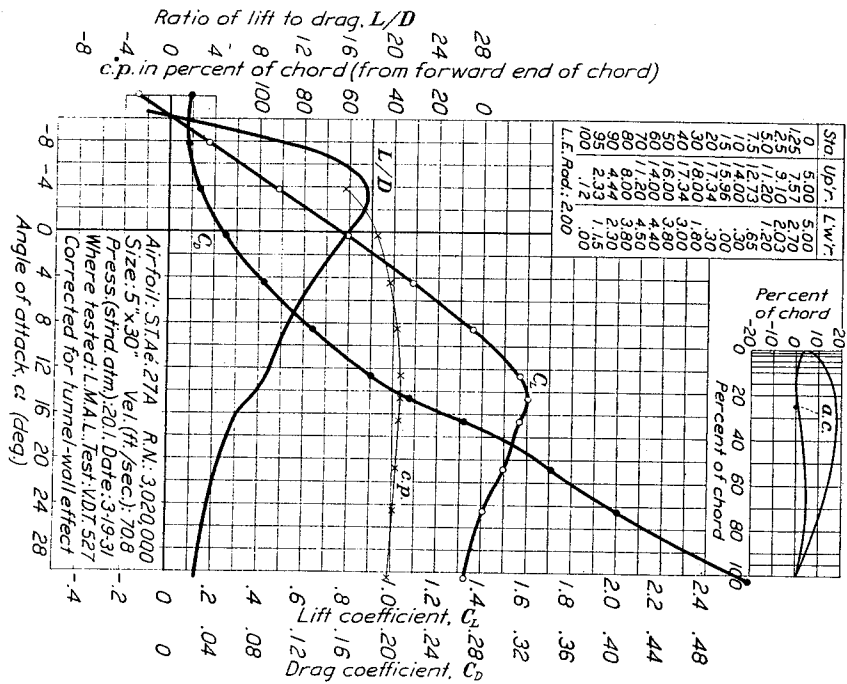
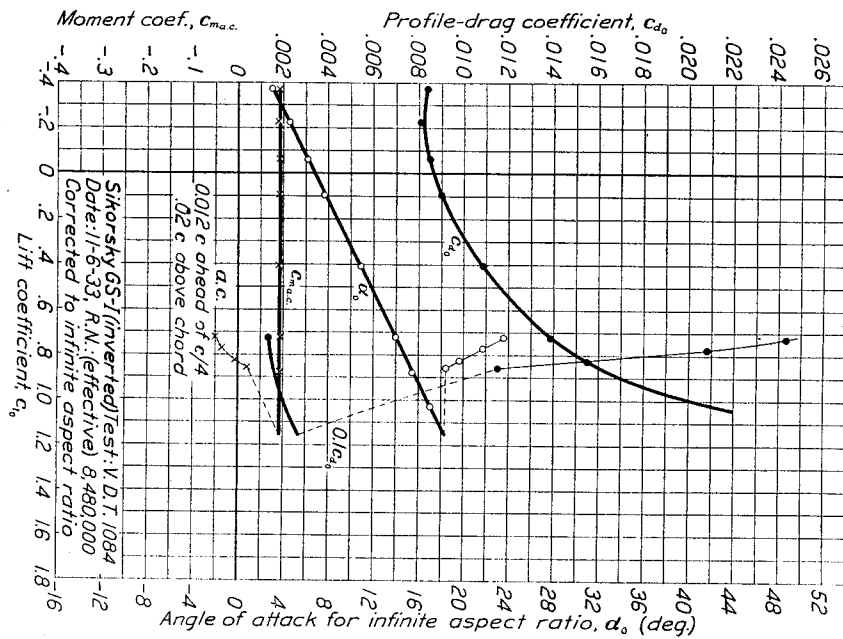
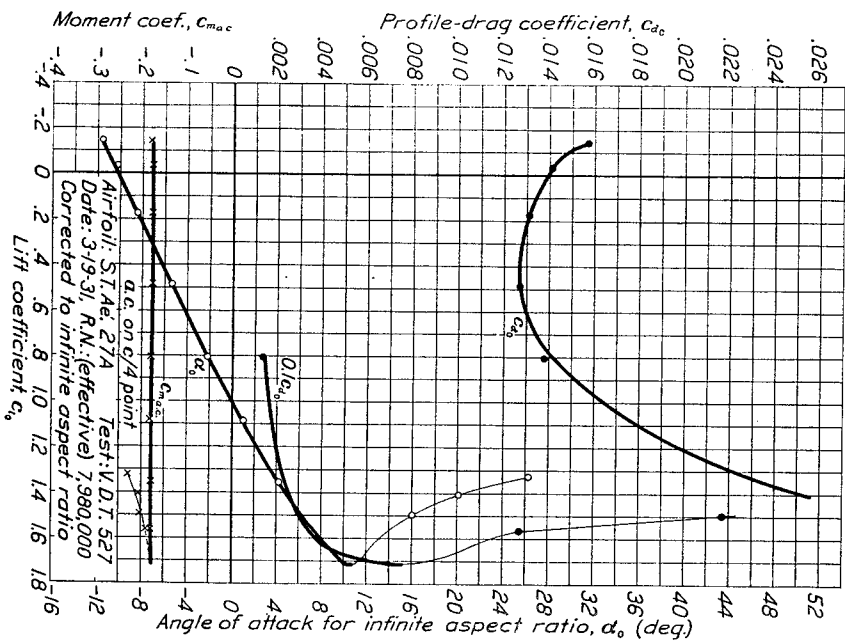


Figure 16.—S. T. A6, 27A airfoil.



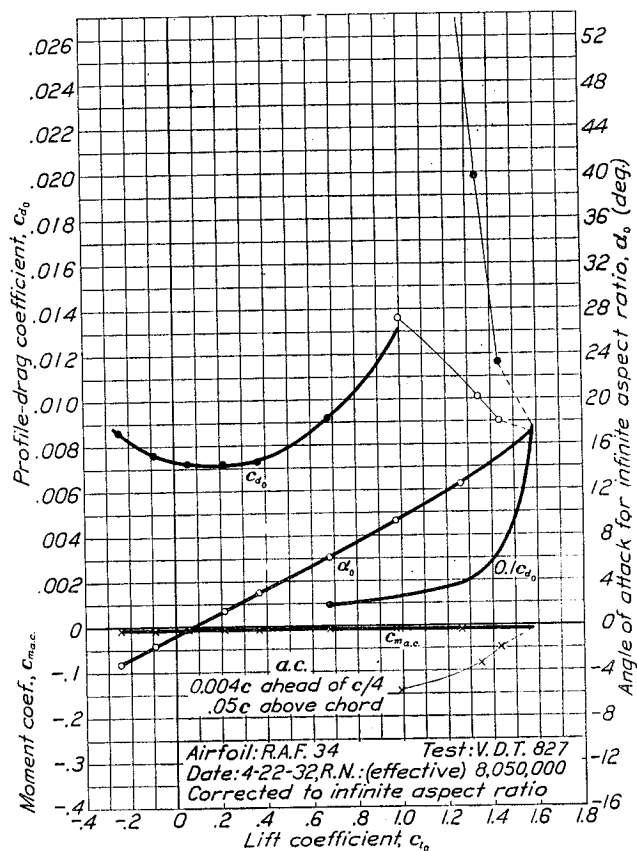
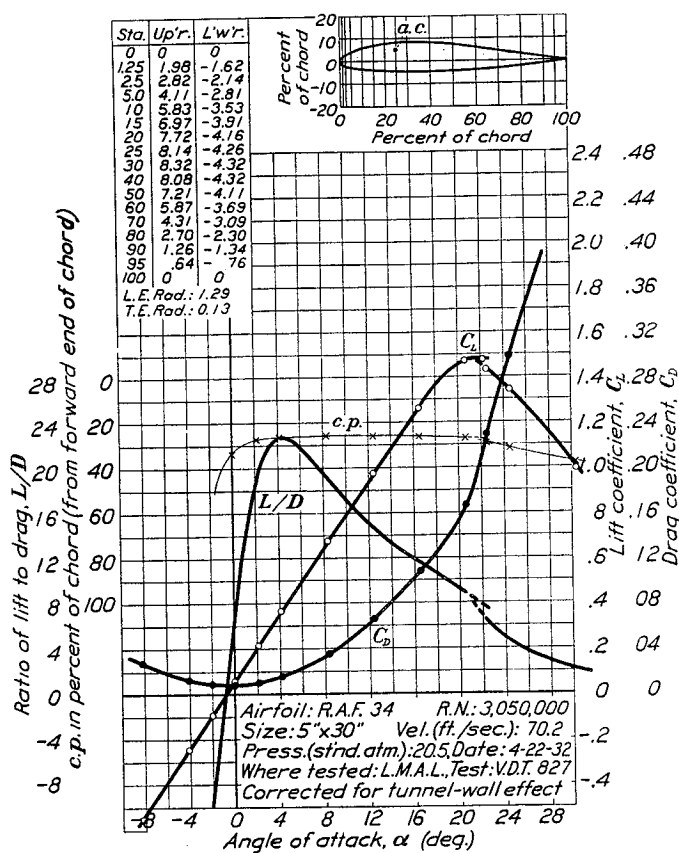


FIGURE 17.—R. A. F. 34 airfoil.

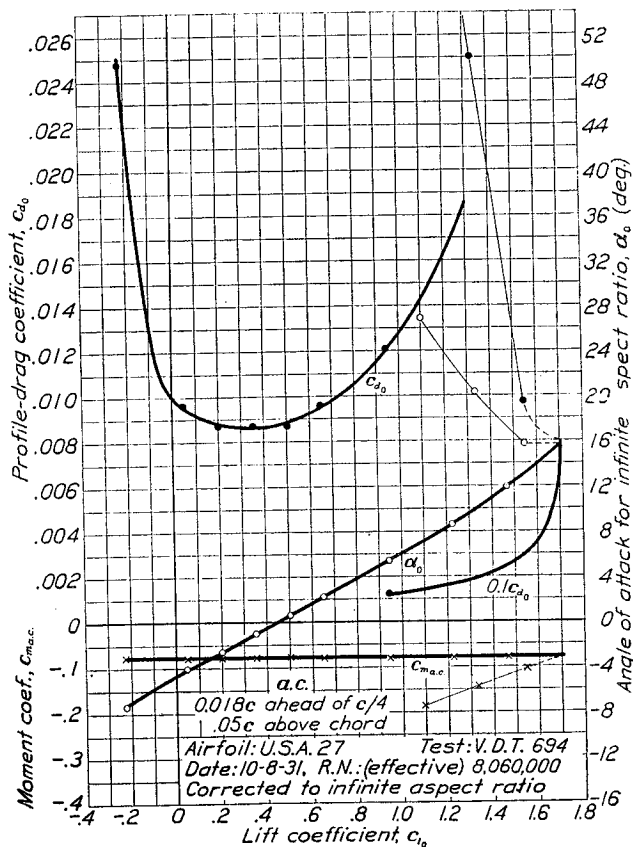
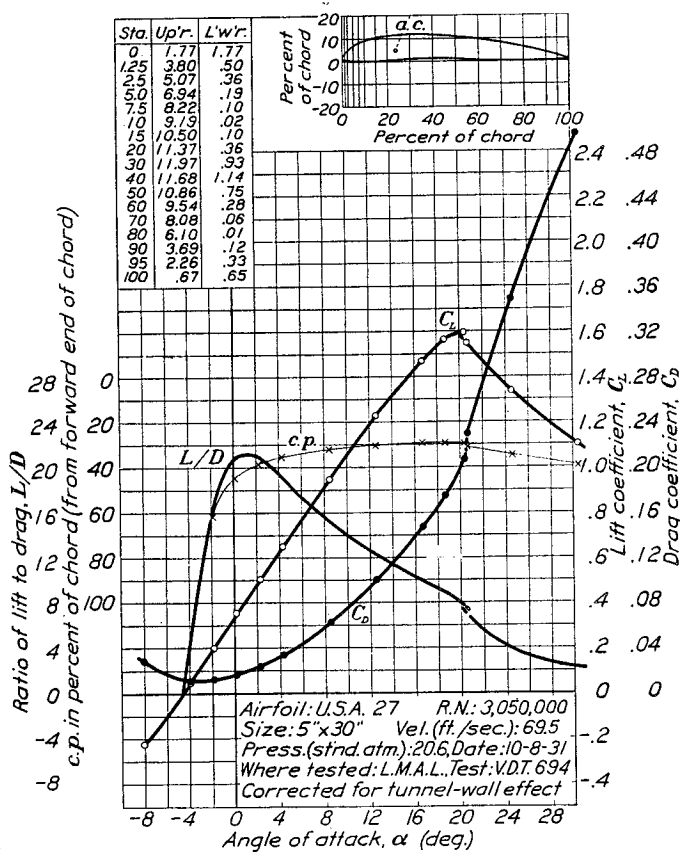


FIGURE 18.—U. S. A. 27 airfoil.

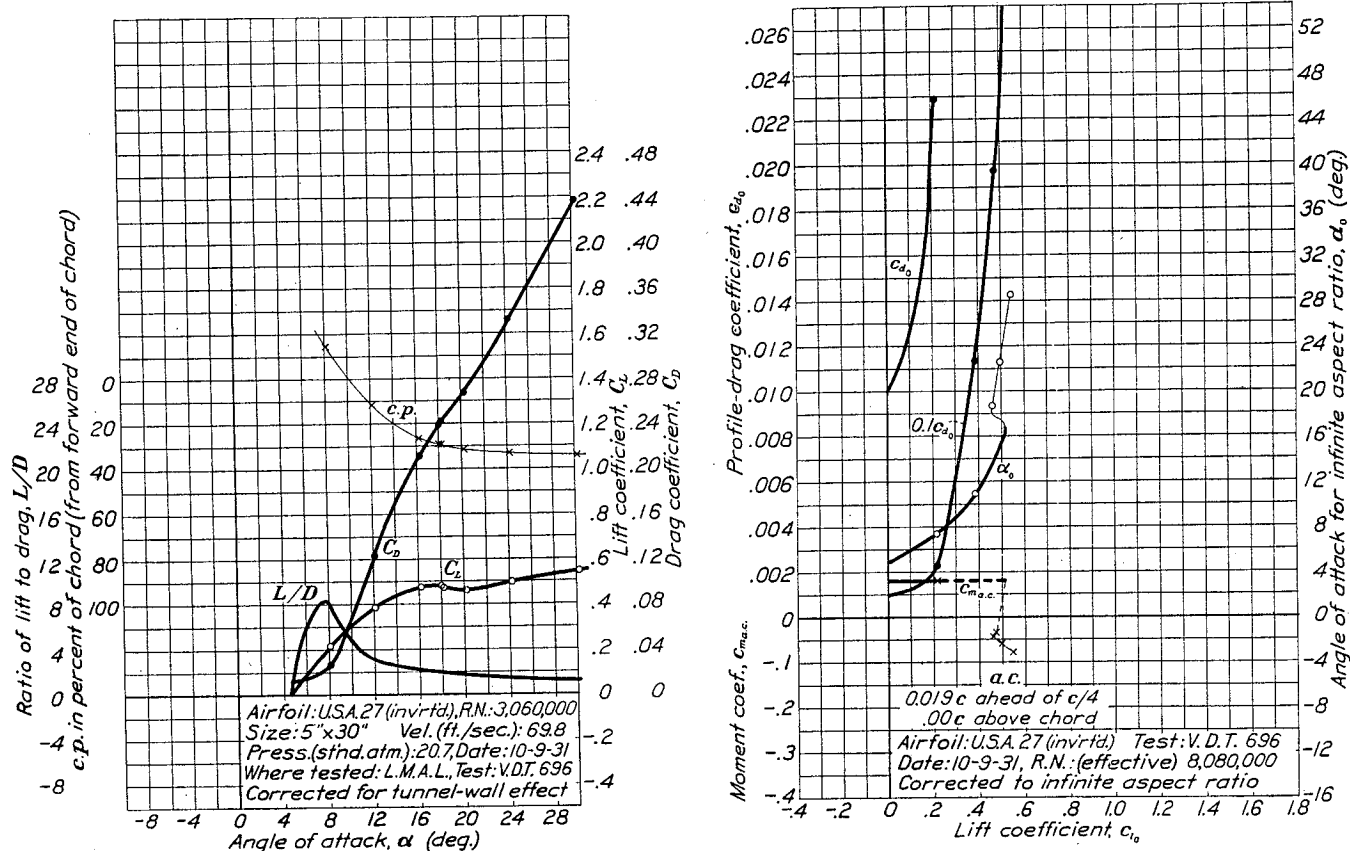


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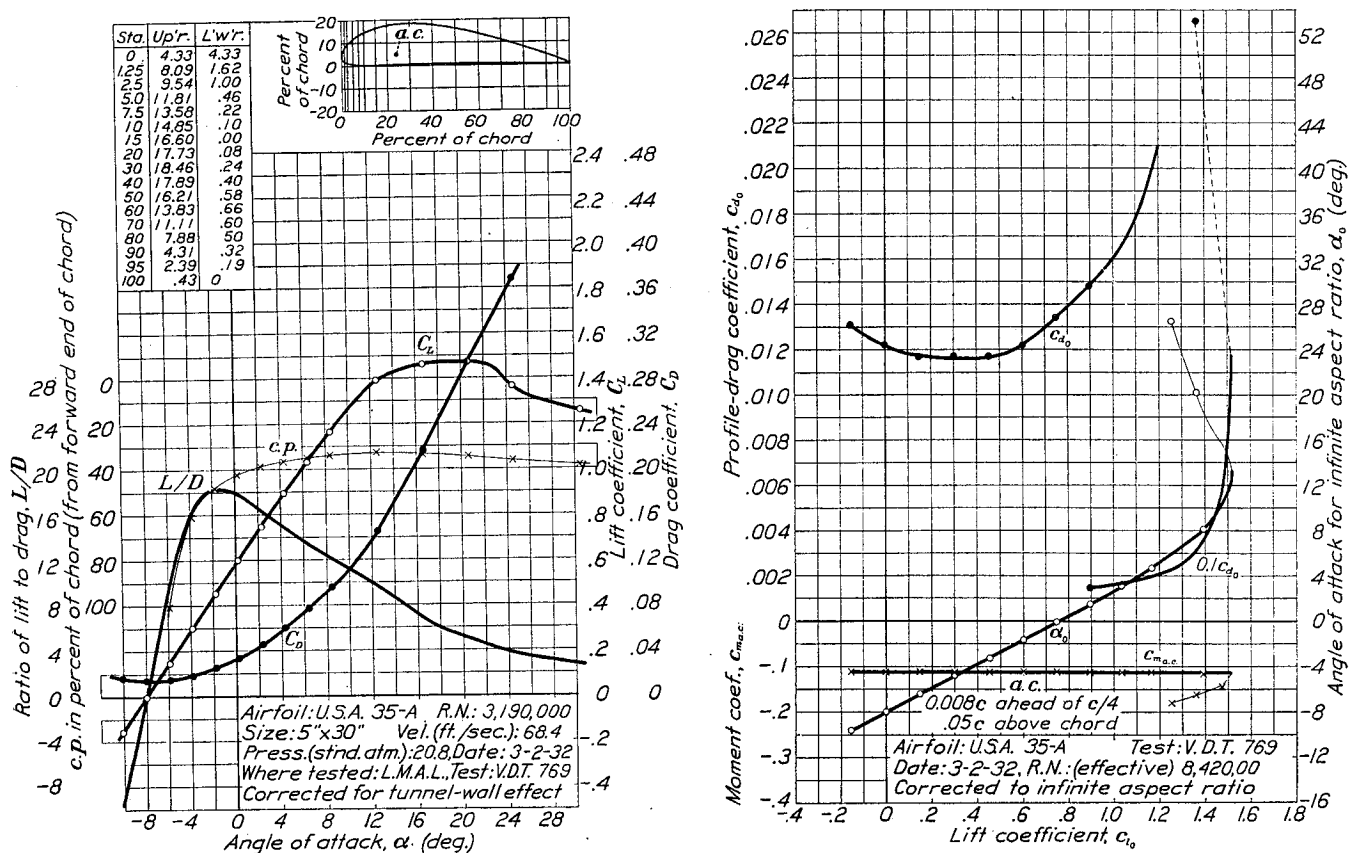


FIGURE 20.—U. S. A. 35-A airfoil.

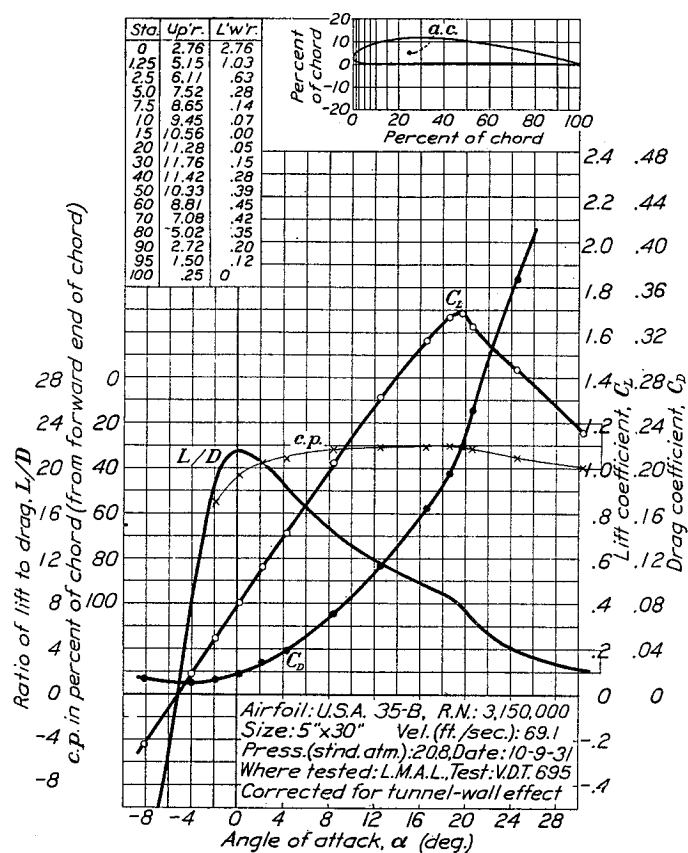


FIGURE 21.—U. S. A. 35-B airfoil.

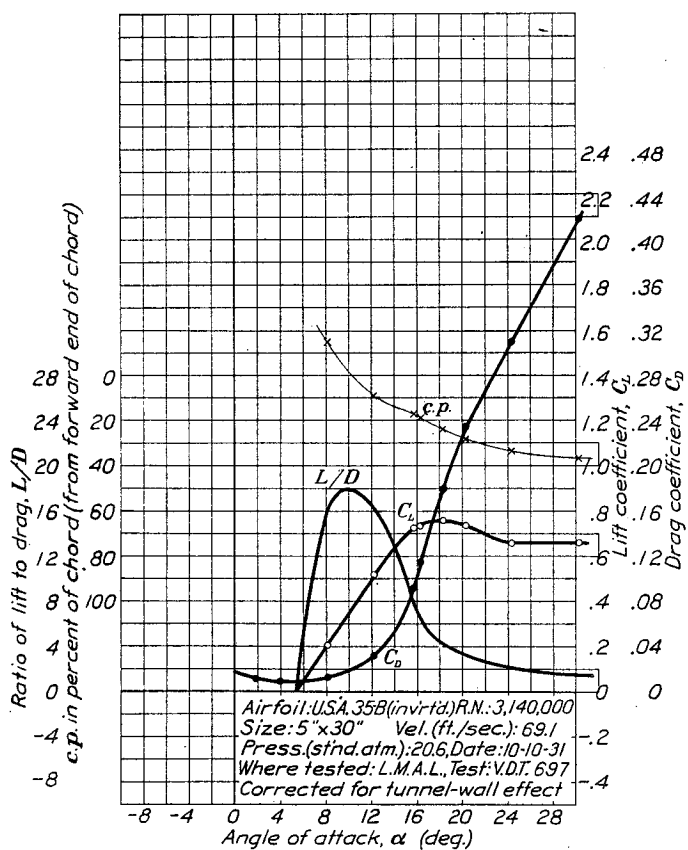
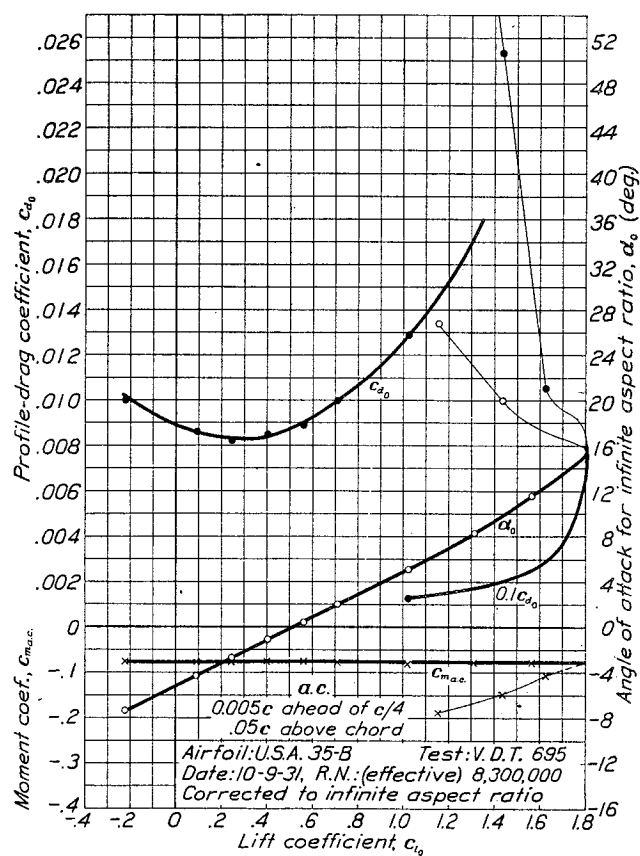
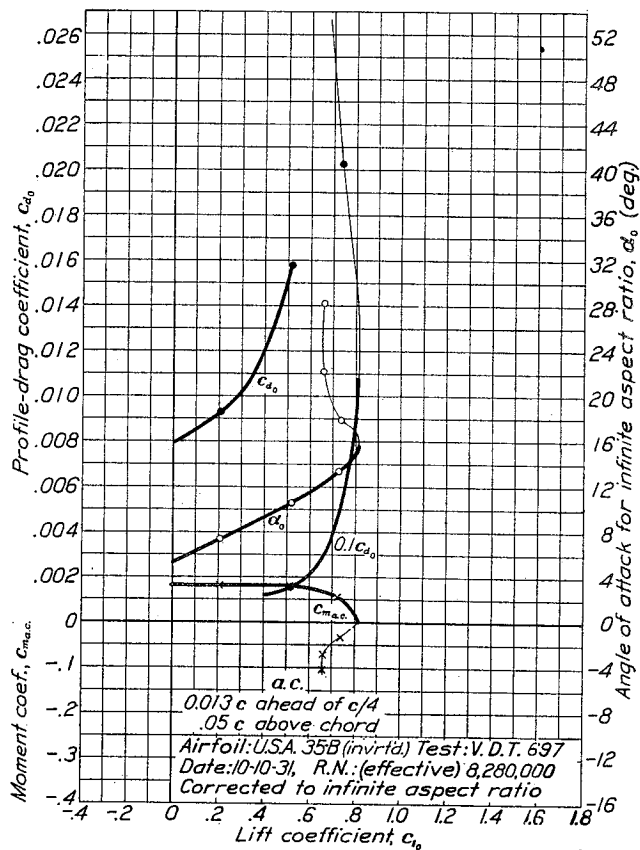


FIGURE 22.—U. S. A. 35-B airfoil (inverted).



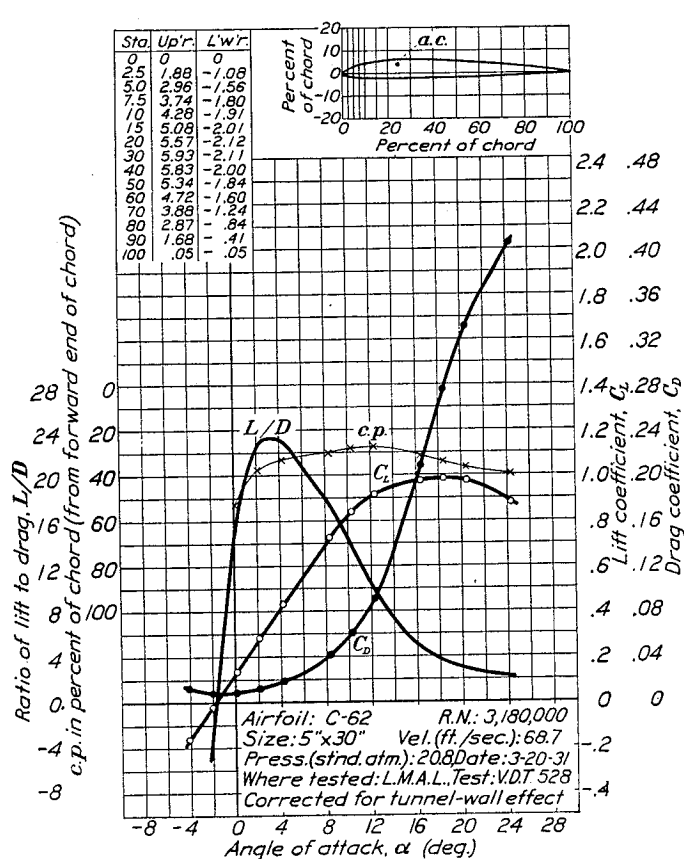


FIGURE 23.—C-62 airfoil.

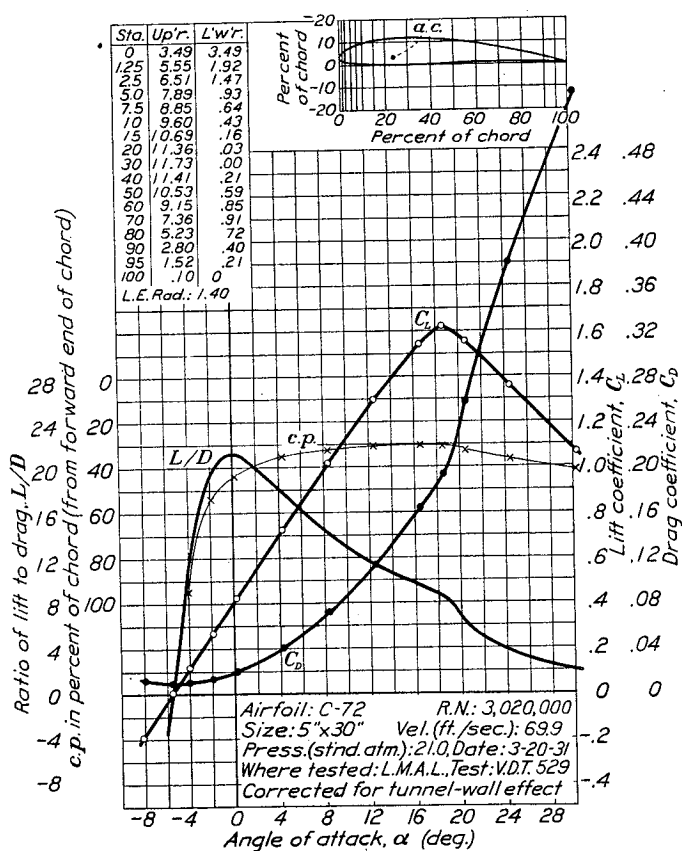
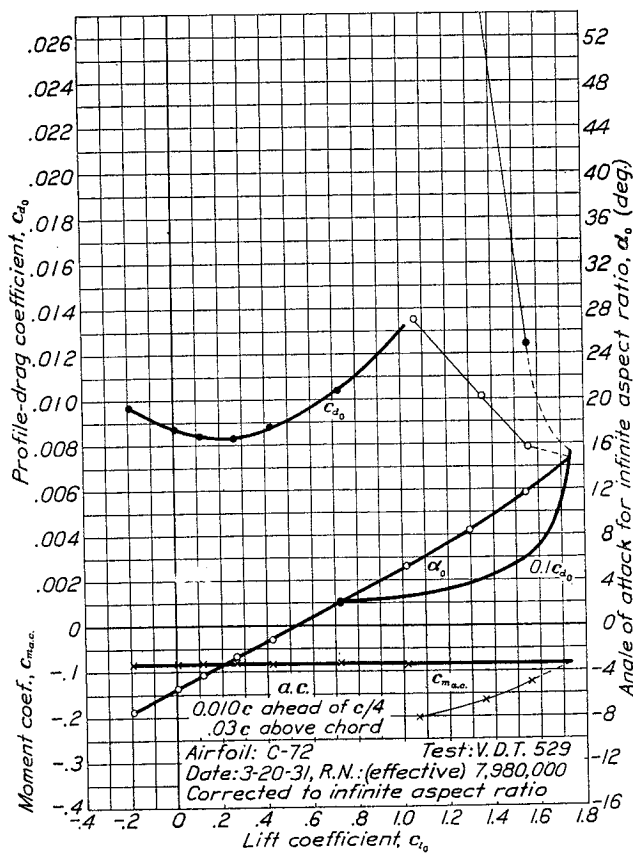
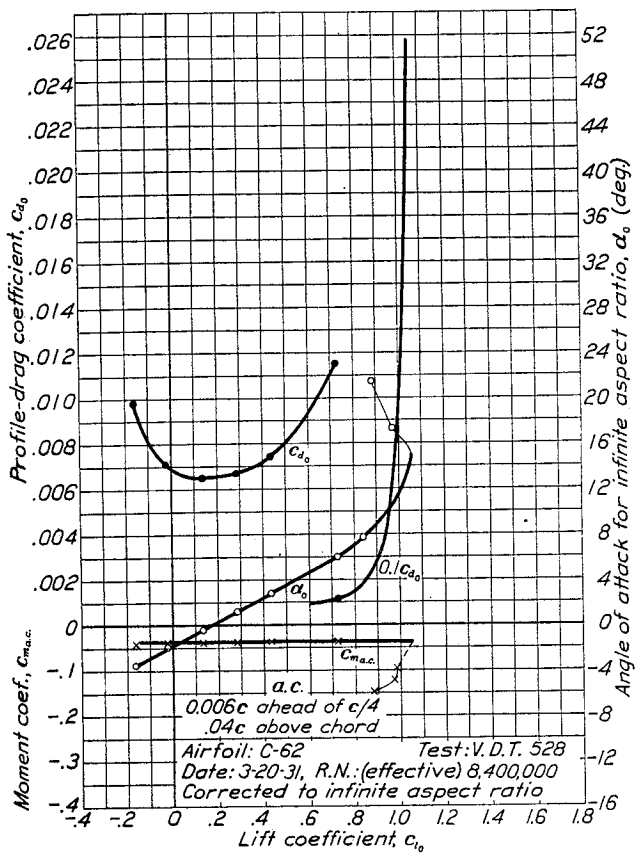


FIGURE 24.—C-72 airfoil.



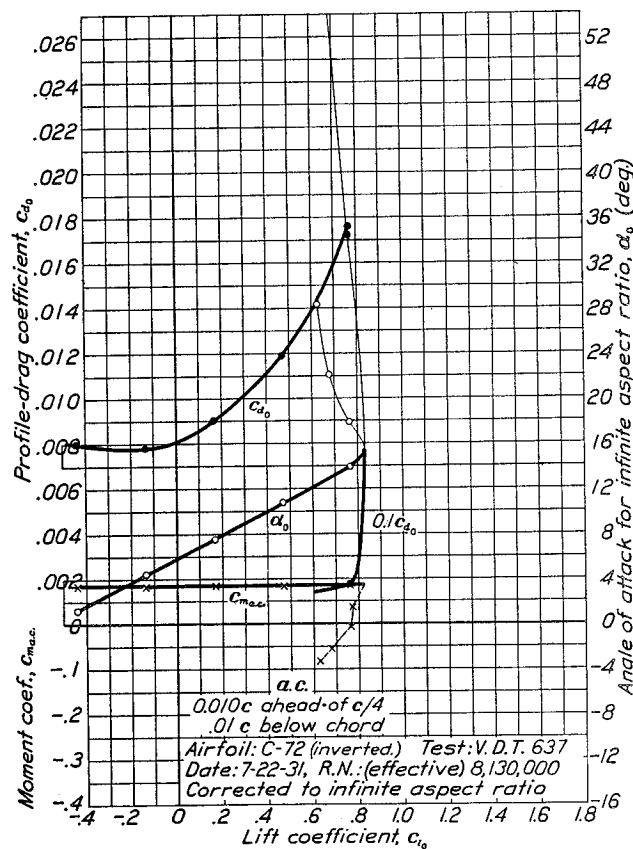
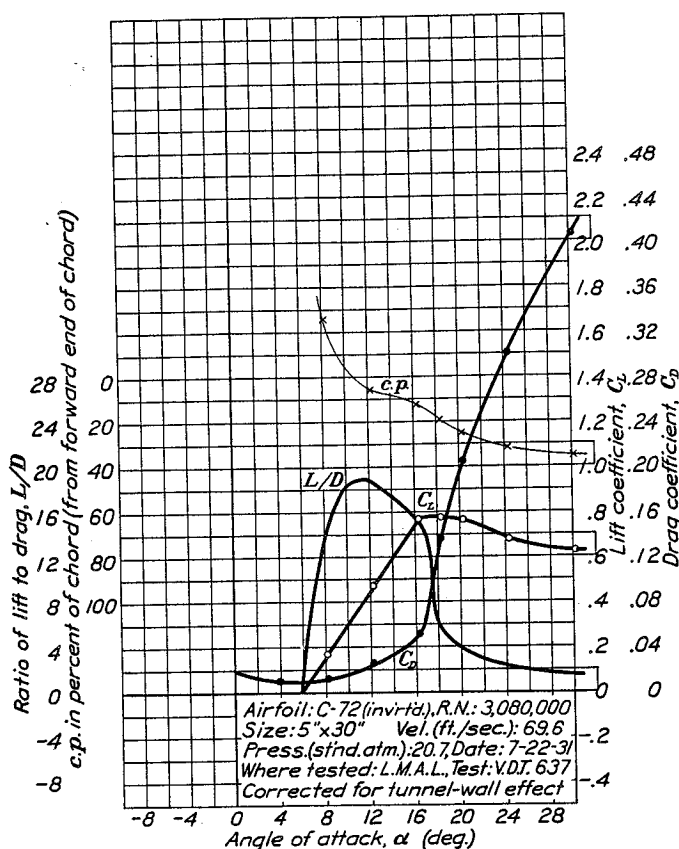


FIGURE 25.—C-72 airfoil (inverted).

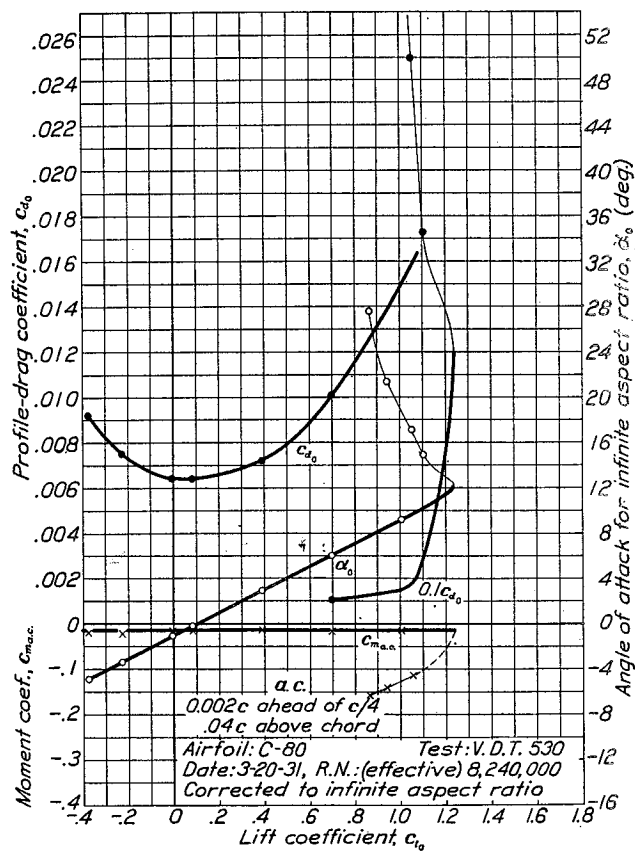
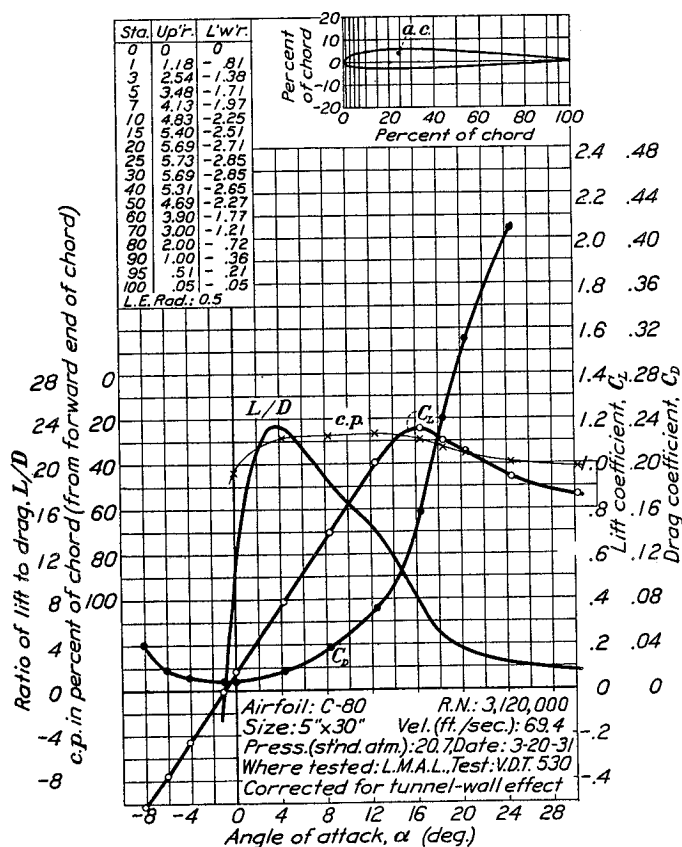


FIGURE 26.—C-80 airfoil.

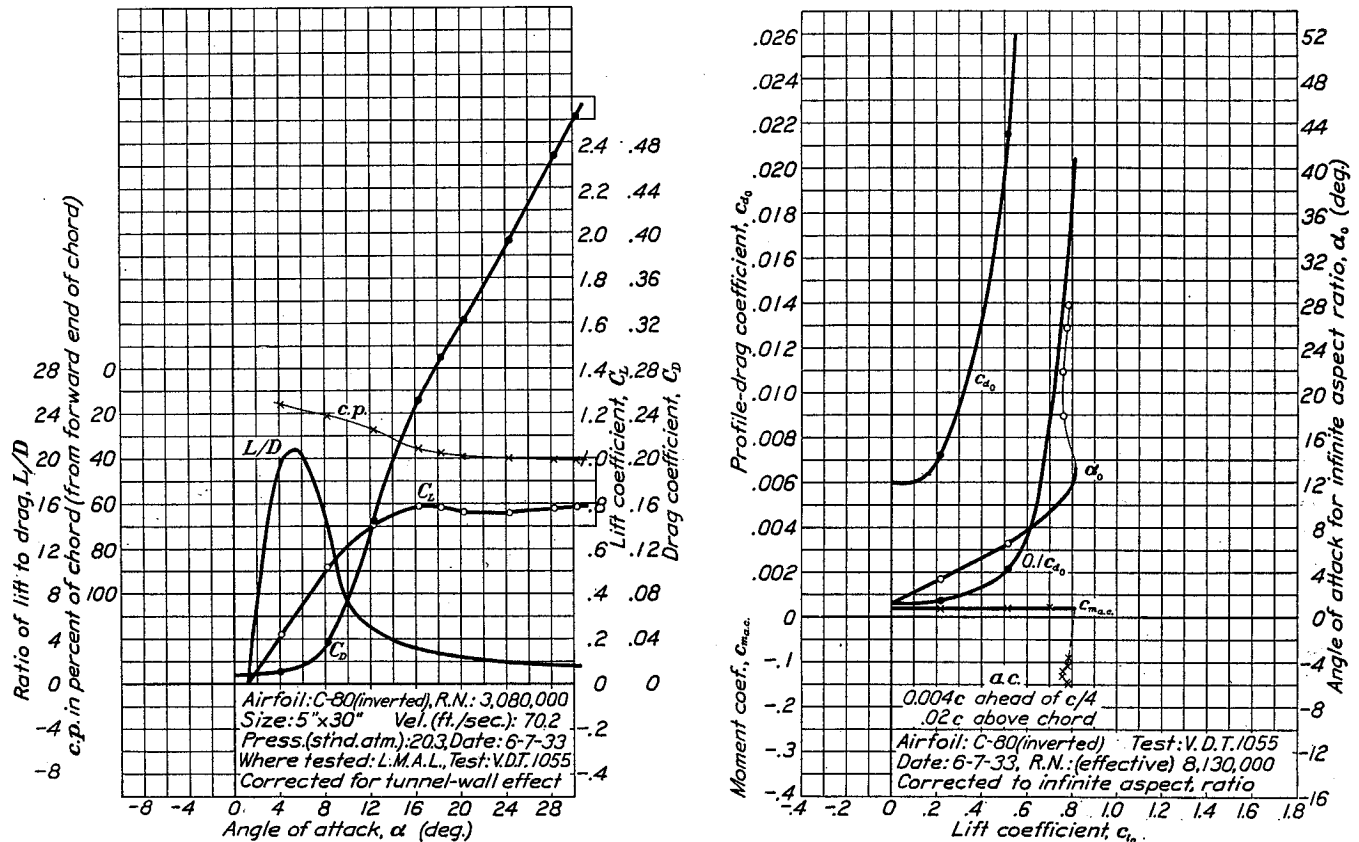


FIGURE 27.—C-80 airfoil (inverted).

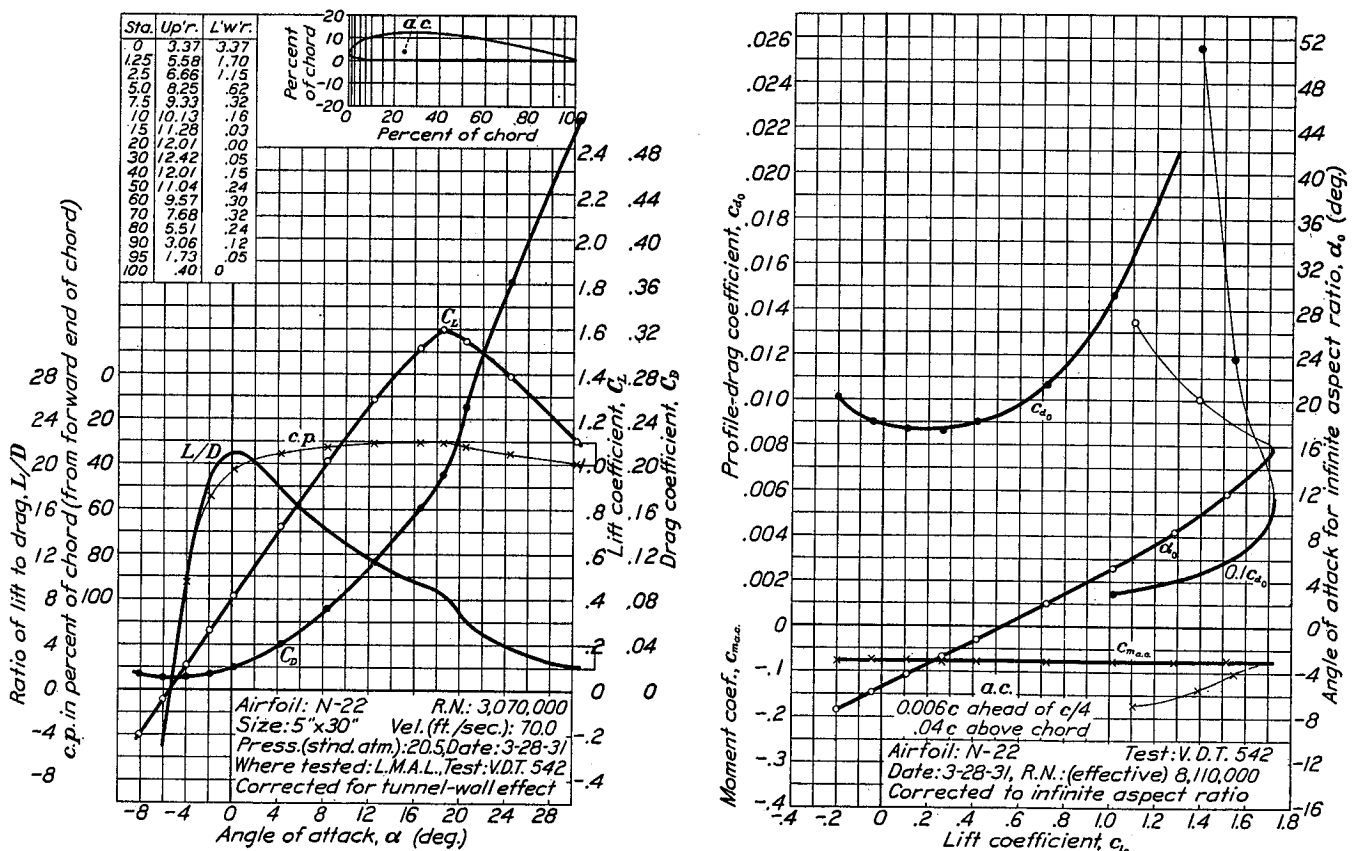


FIGURE 28.—N-22 airfoil.

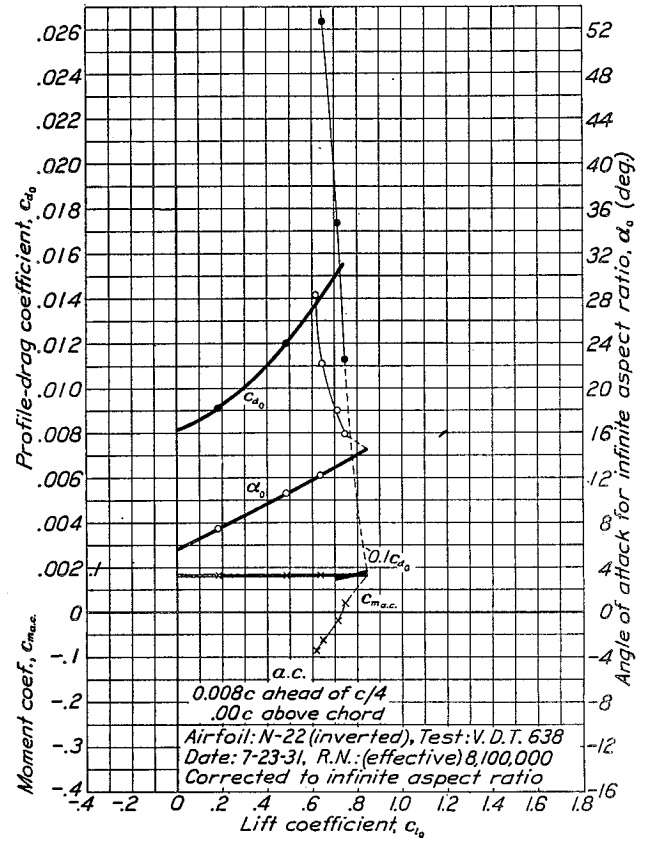
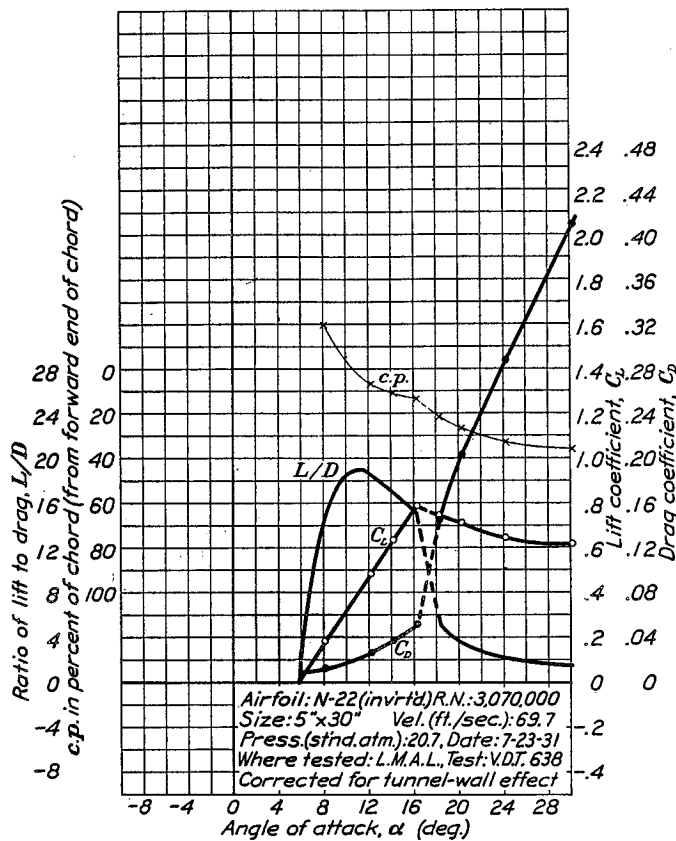


FIGURE 29.—N-22 airfoil (inverted).

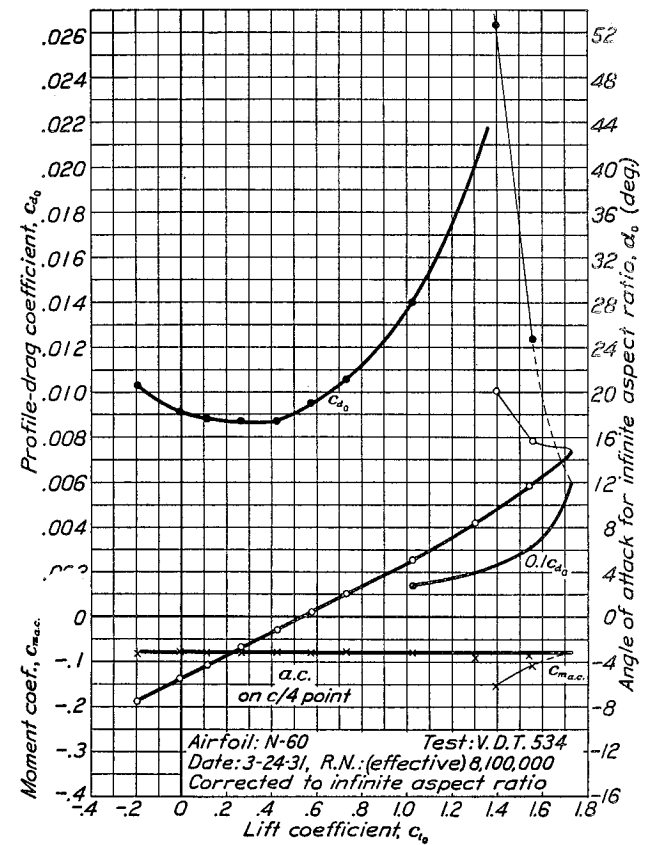
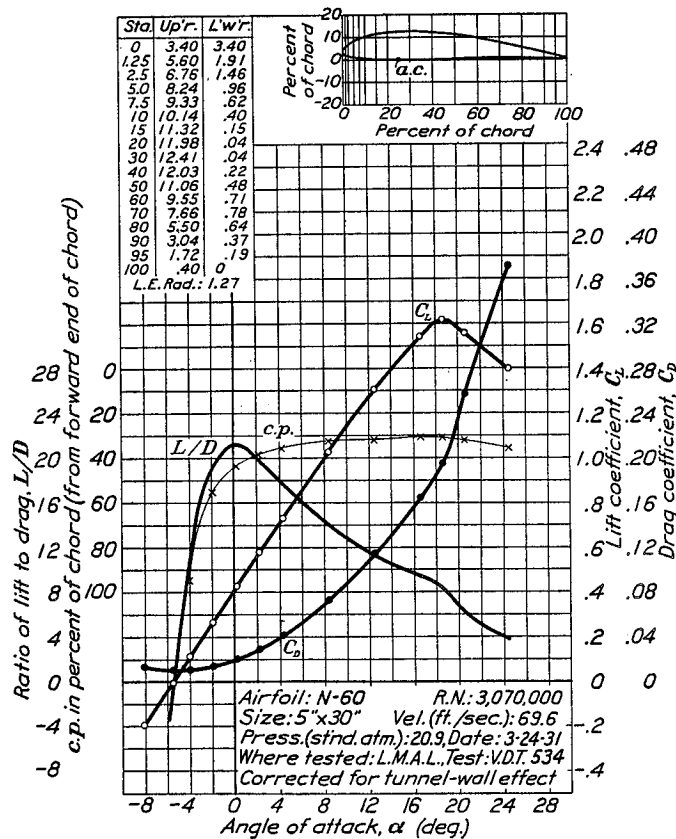


FIGURE 30.—N-60 airfoil.

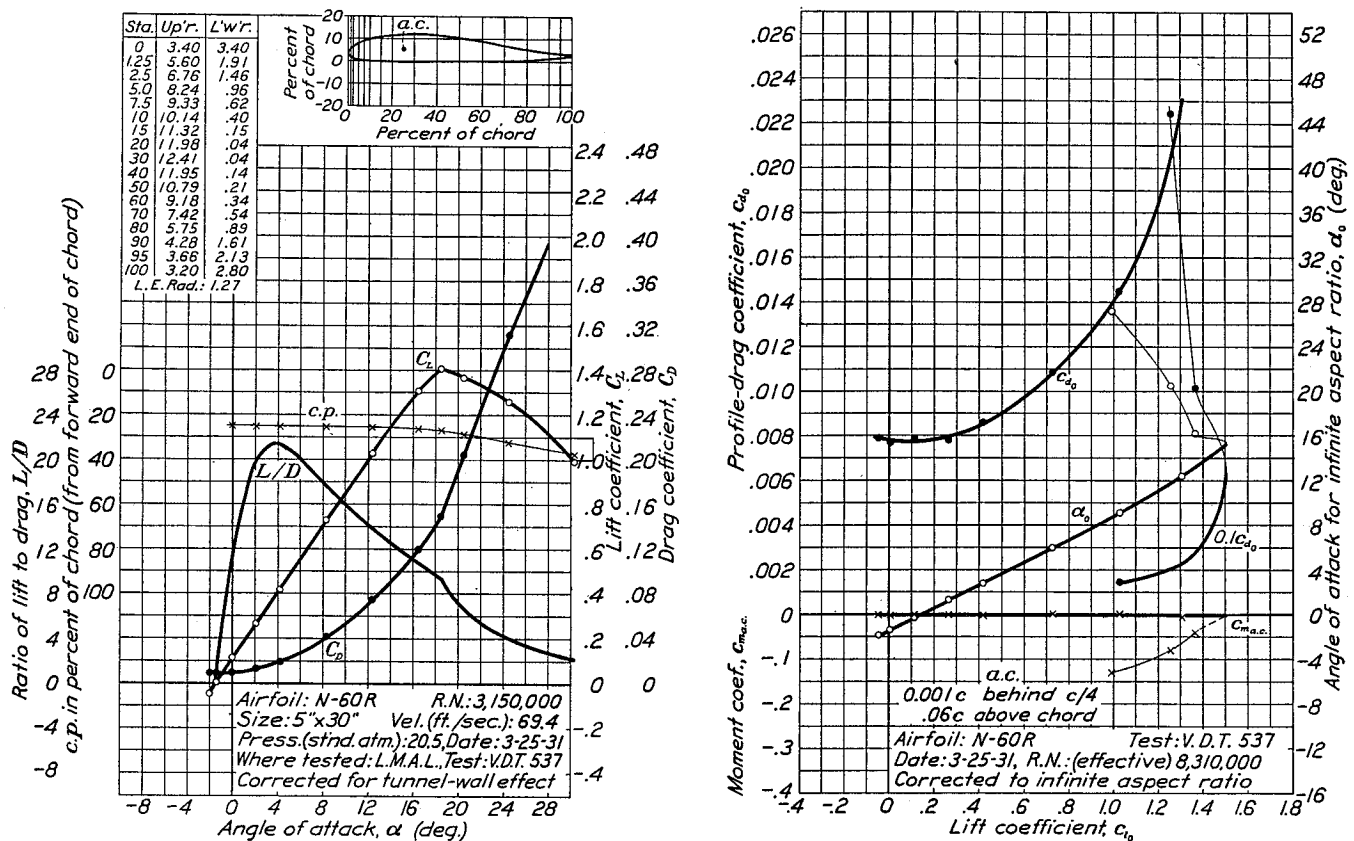


FIGURE 31.—N-60 R airfoil.

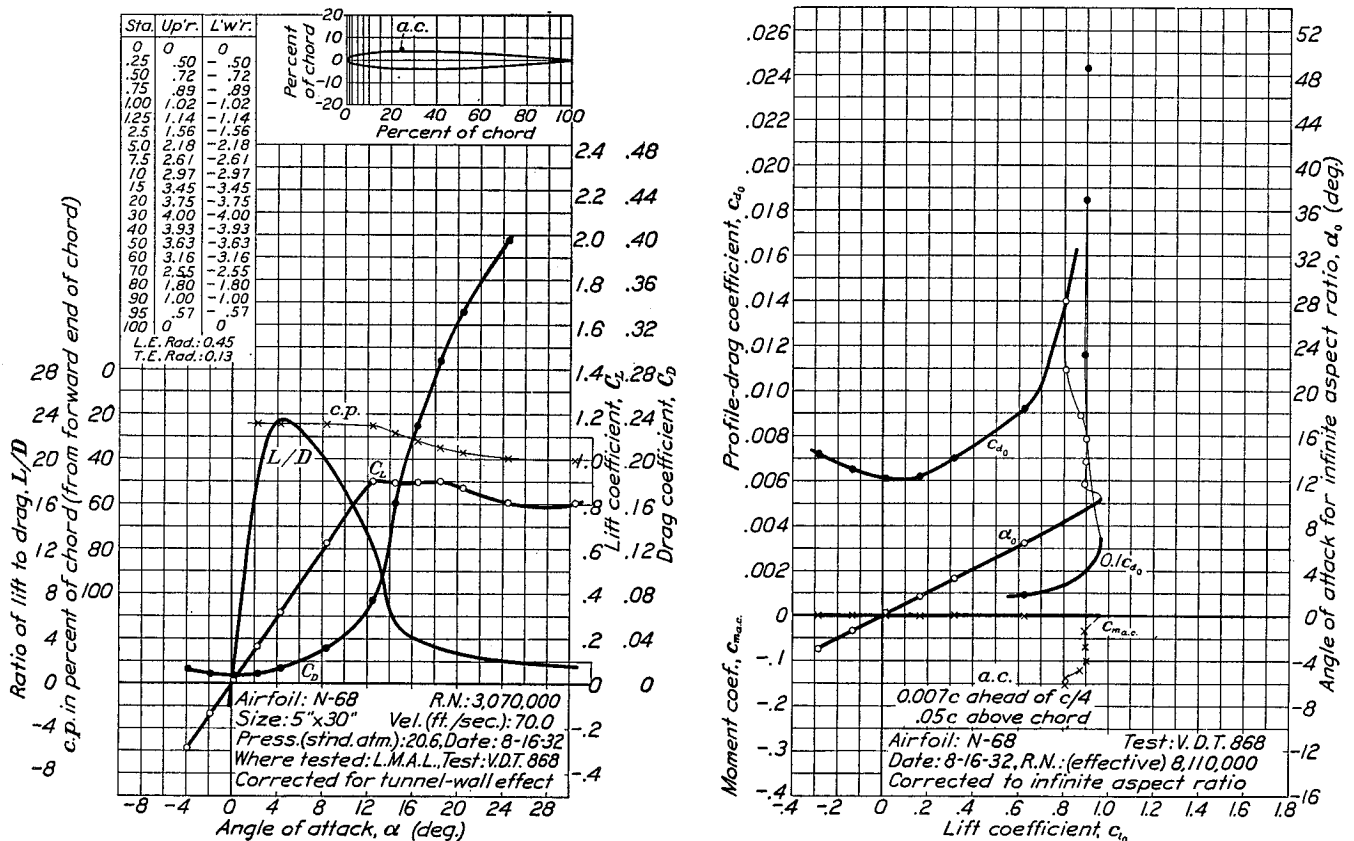


FIGURE 32.—N-68 airfoil.

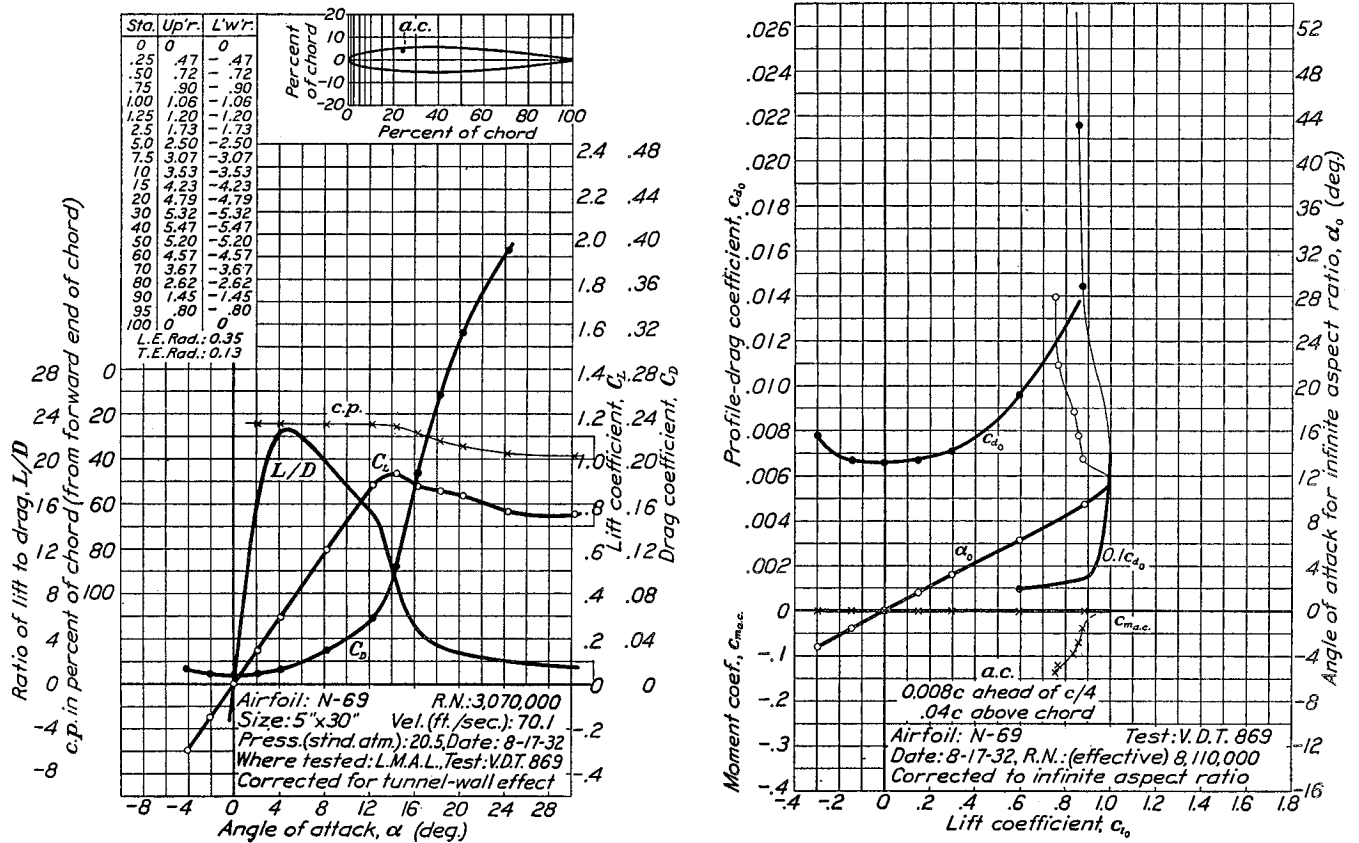


FIGURE 33.—N-69 airfoil.

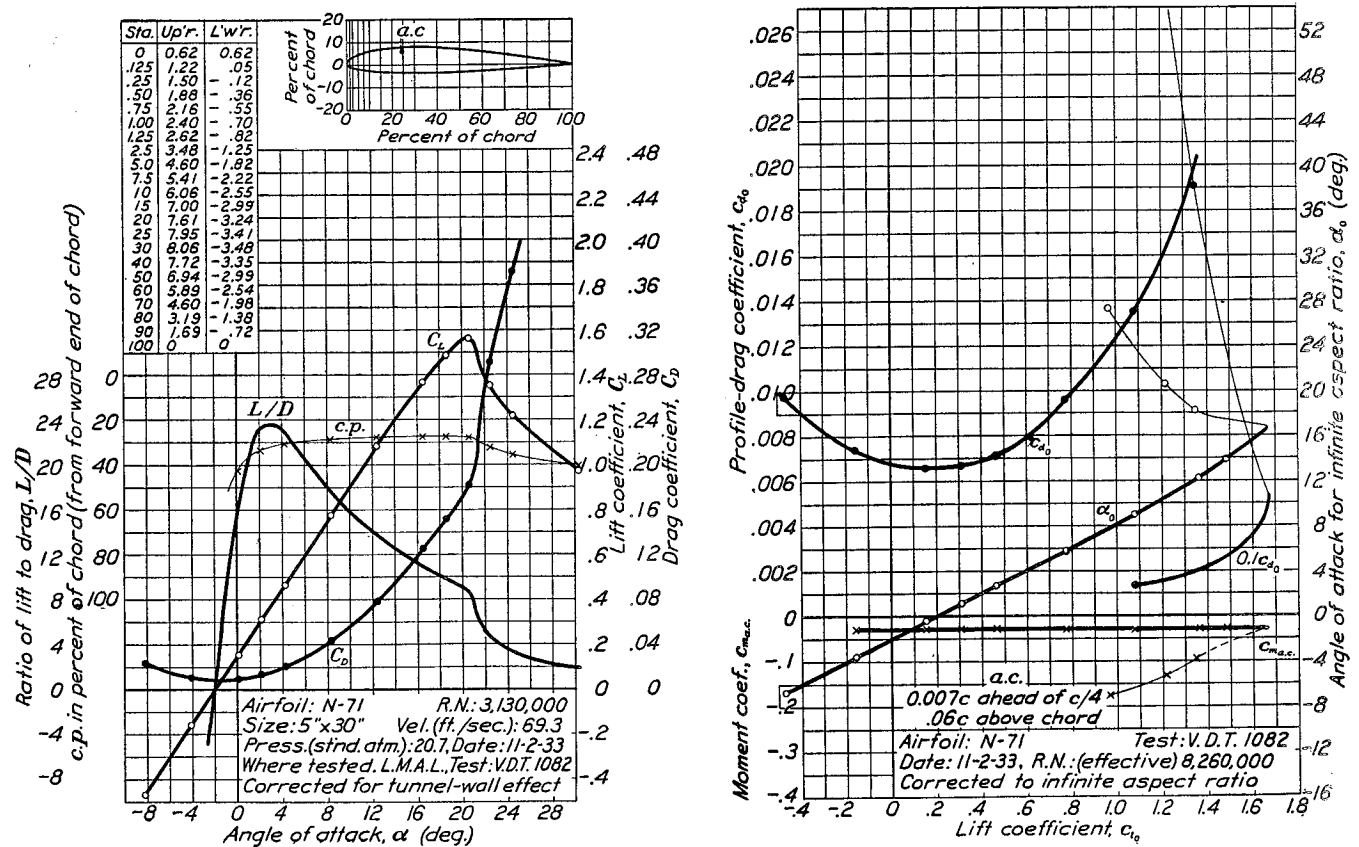


FIGURE 34.—N-71 airfoil.

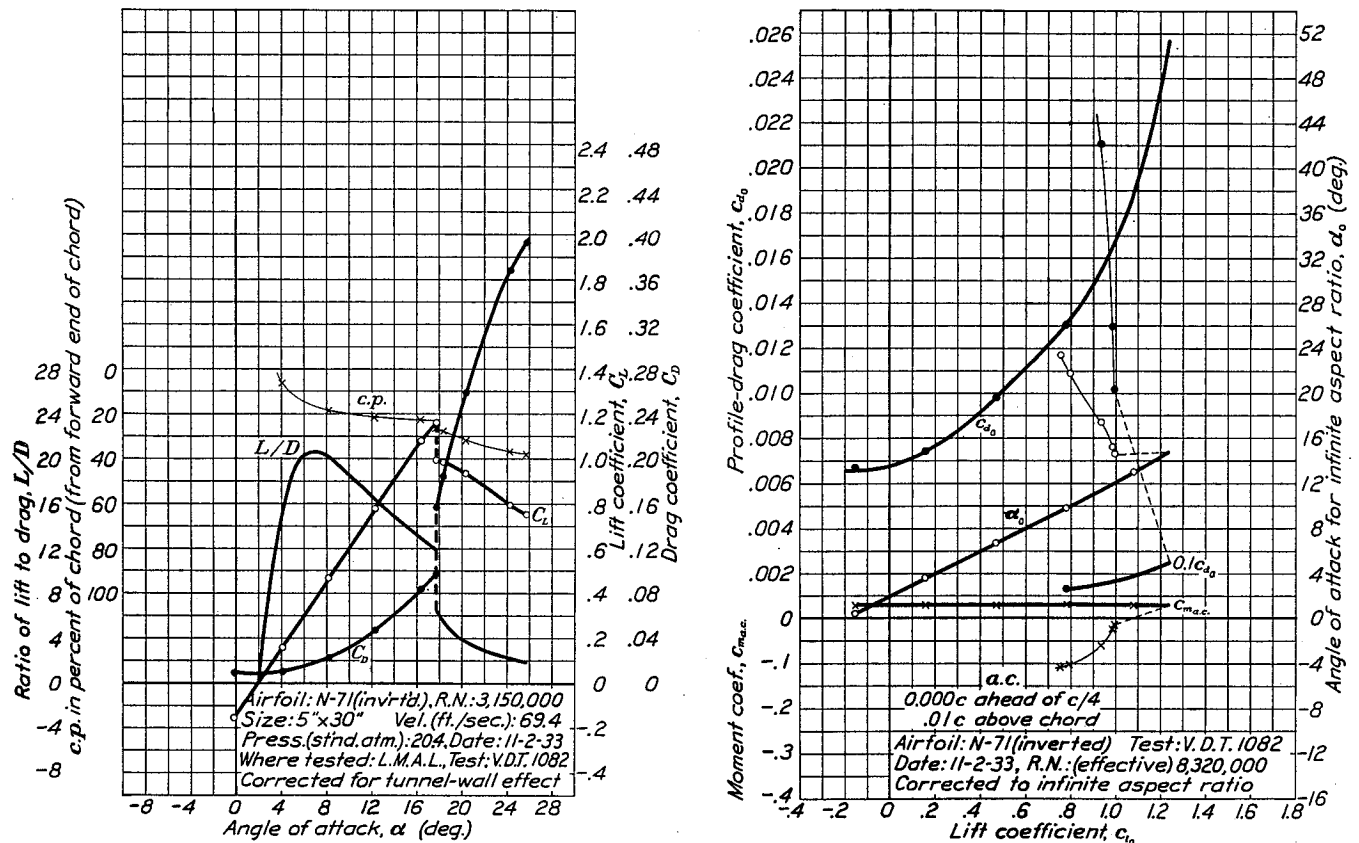


FIGURE 35.—N-71 airfoil (Inverted).

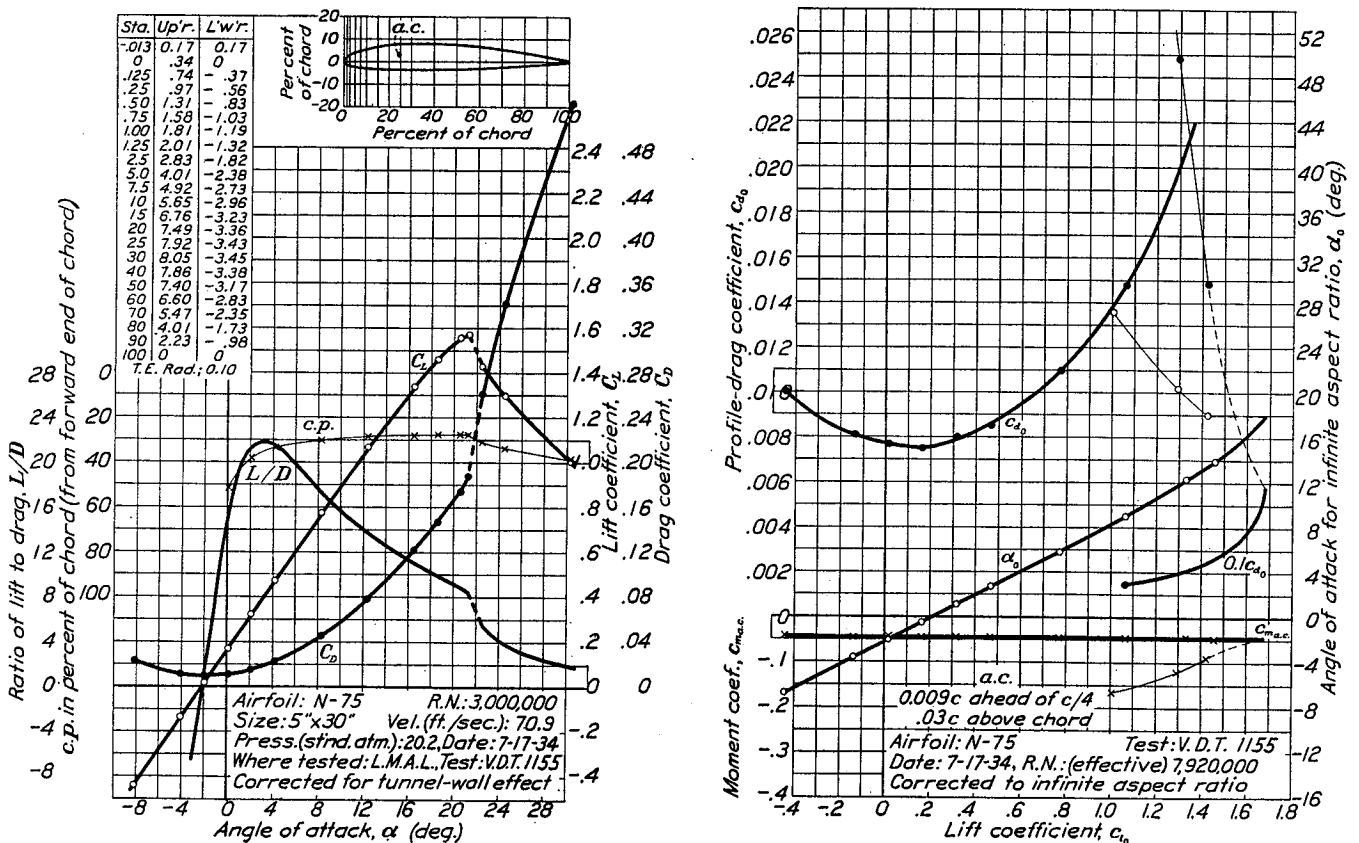


FIGURE 36.—N-75 airfoil.

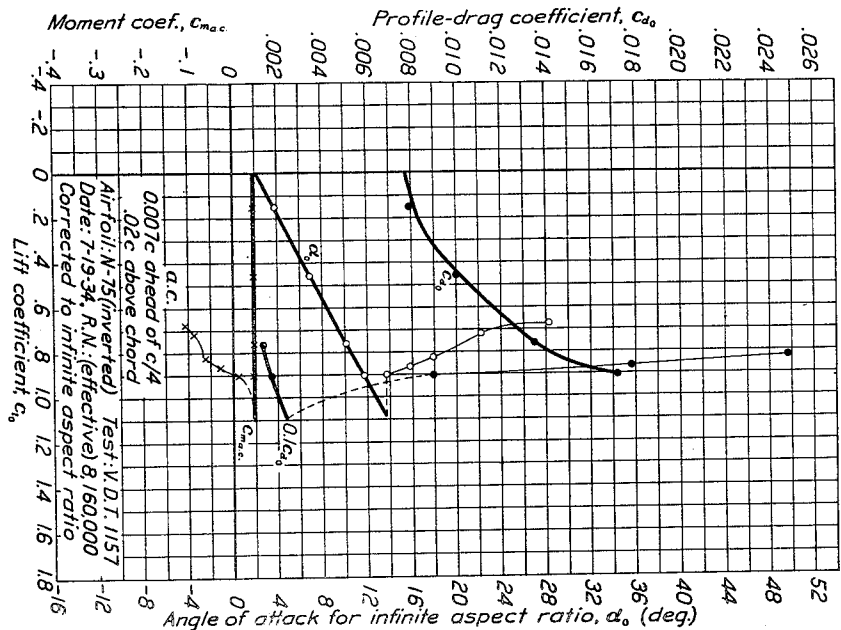


FIGURE 37.—N-75 airfoil (inverted).

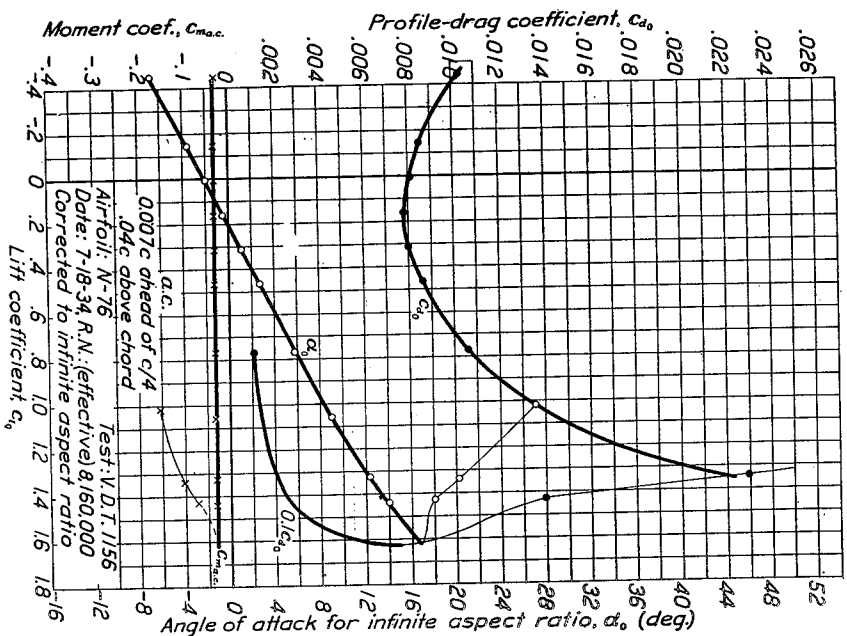


FIGURE 38.—N-76 airfoil.

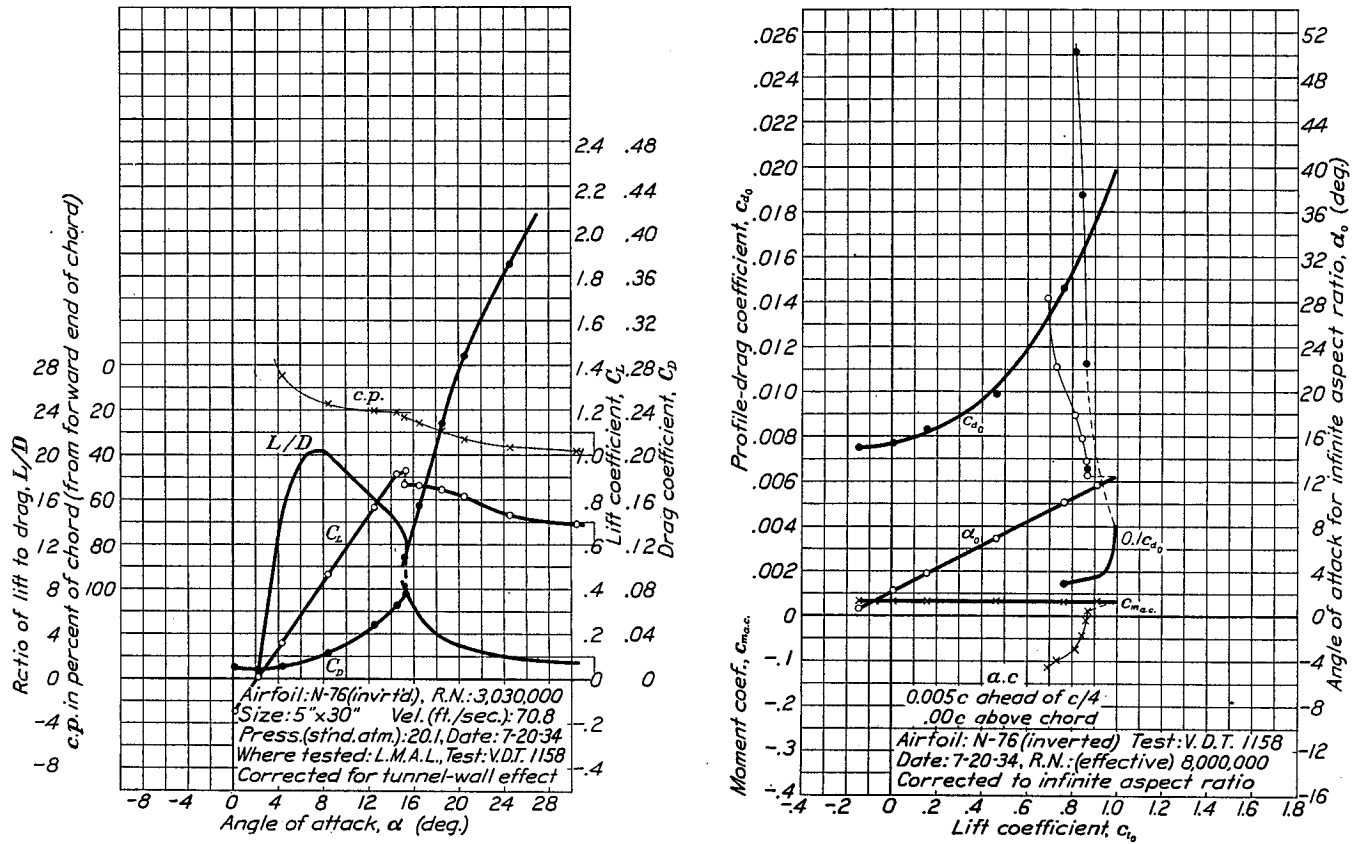


FIGURE 39.—N-76 airfoil (inverted).

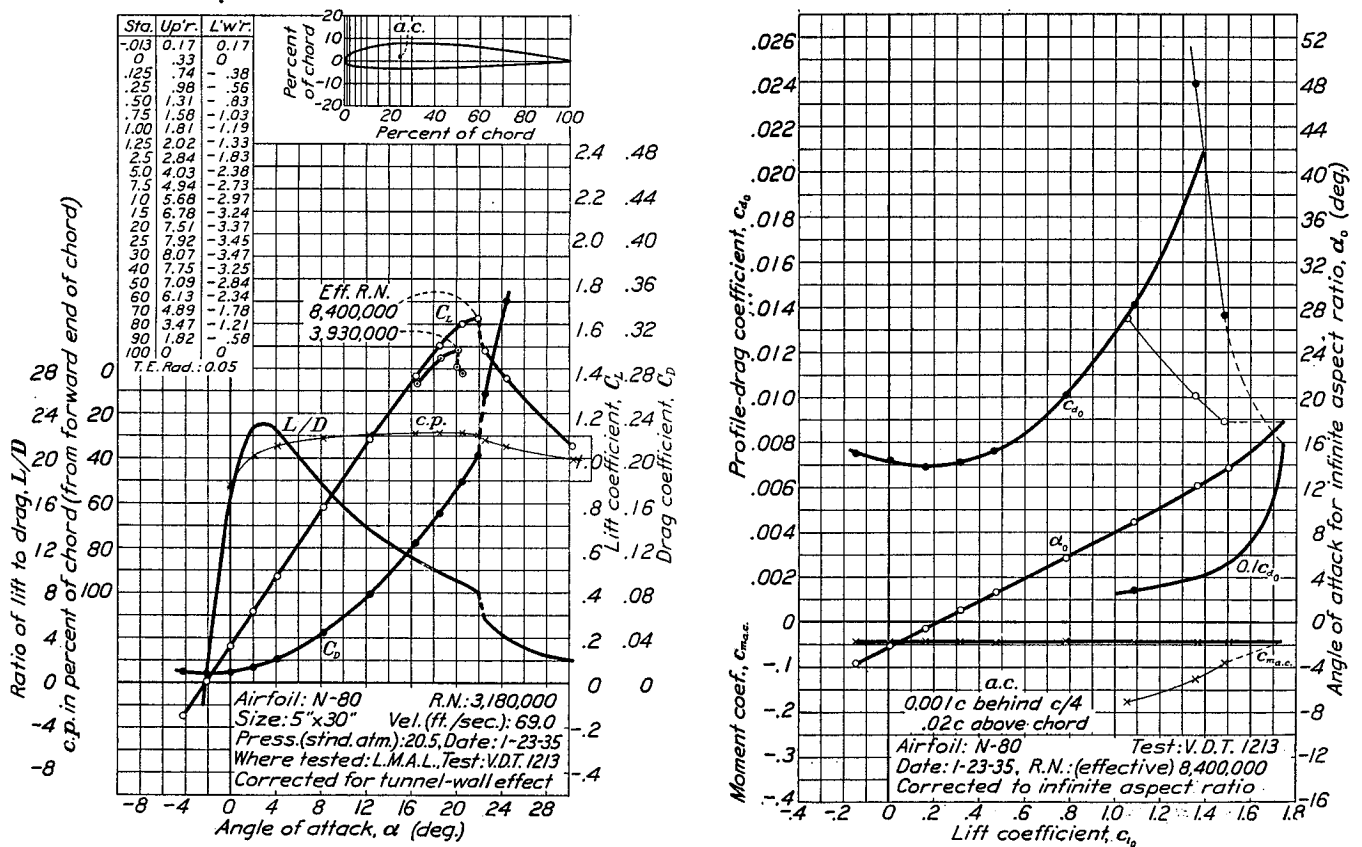


FIGURE 40.—N-80 airfoil.

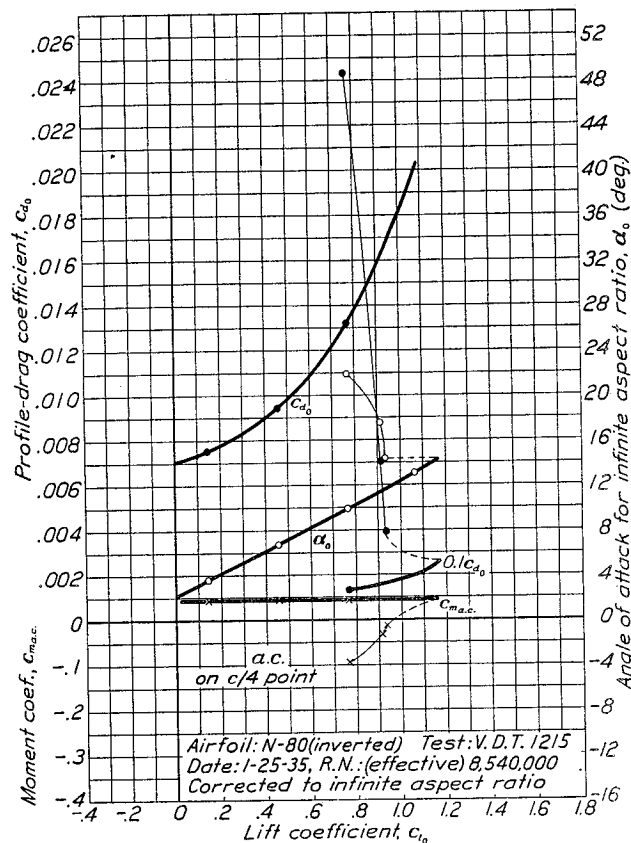
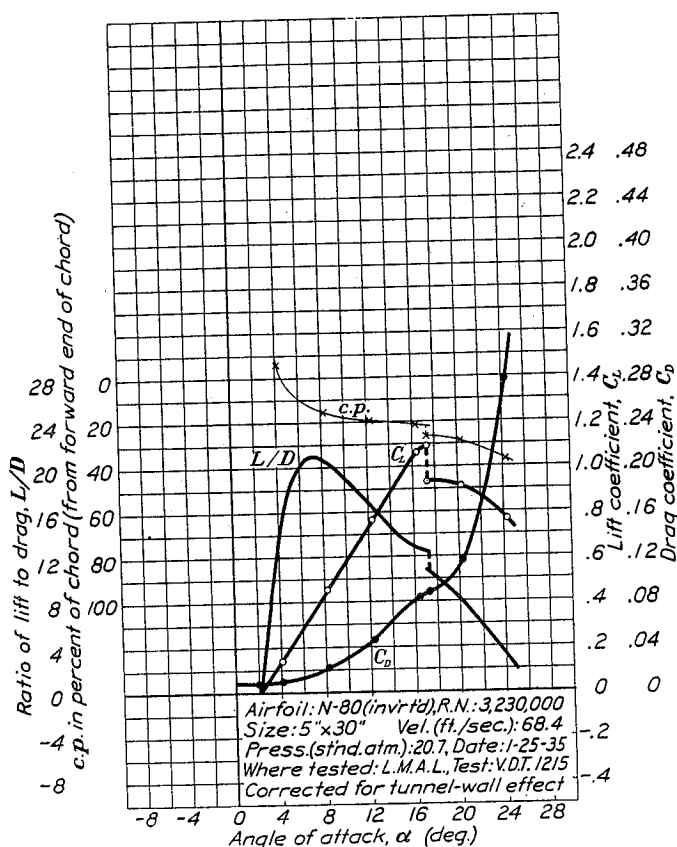


FIGURE 41.—N-80 airfoil (inverted).

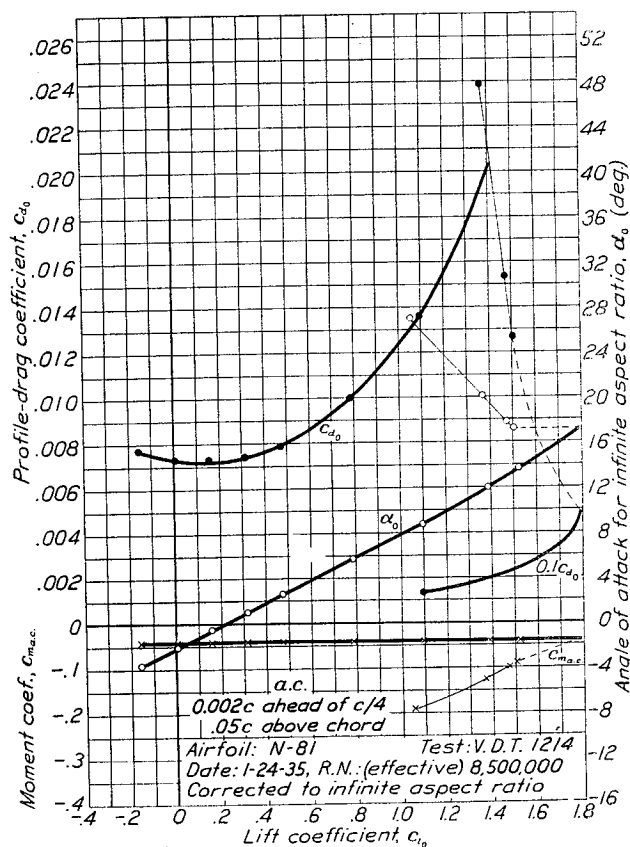
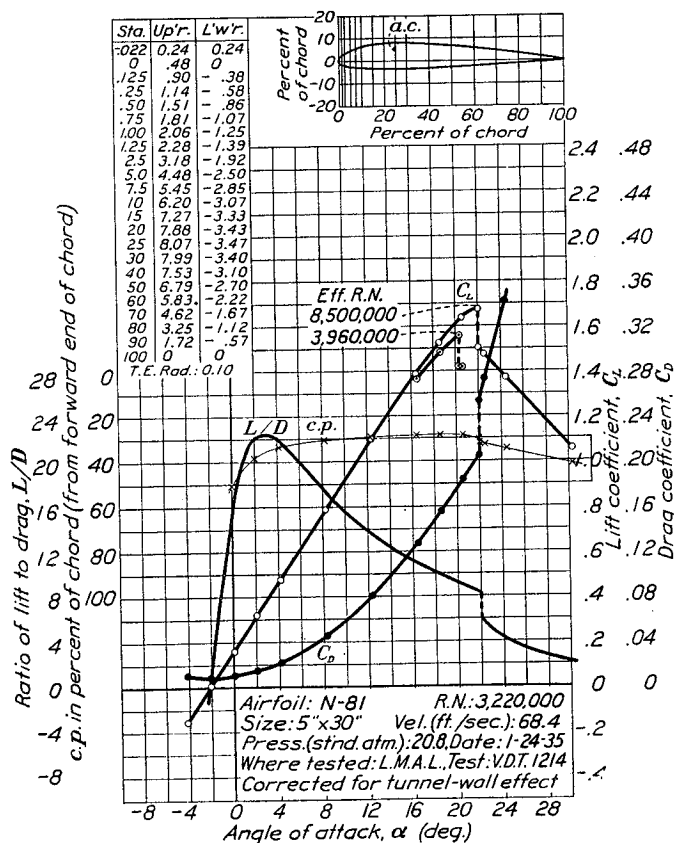


FIGURE 42.—N-81 airfoil.

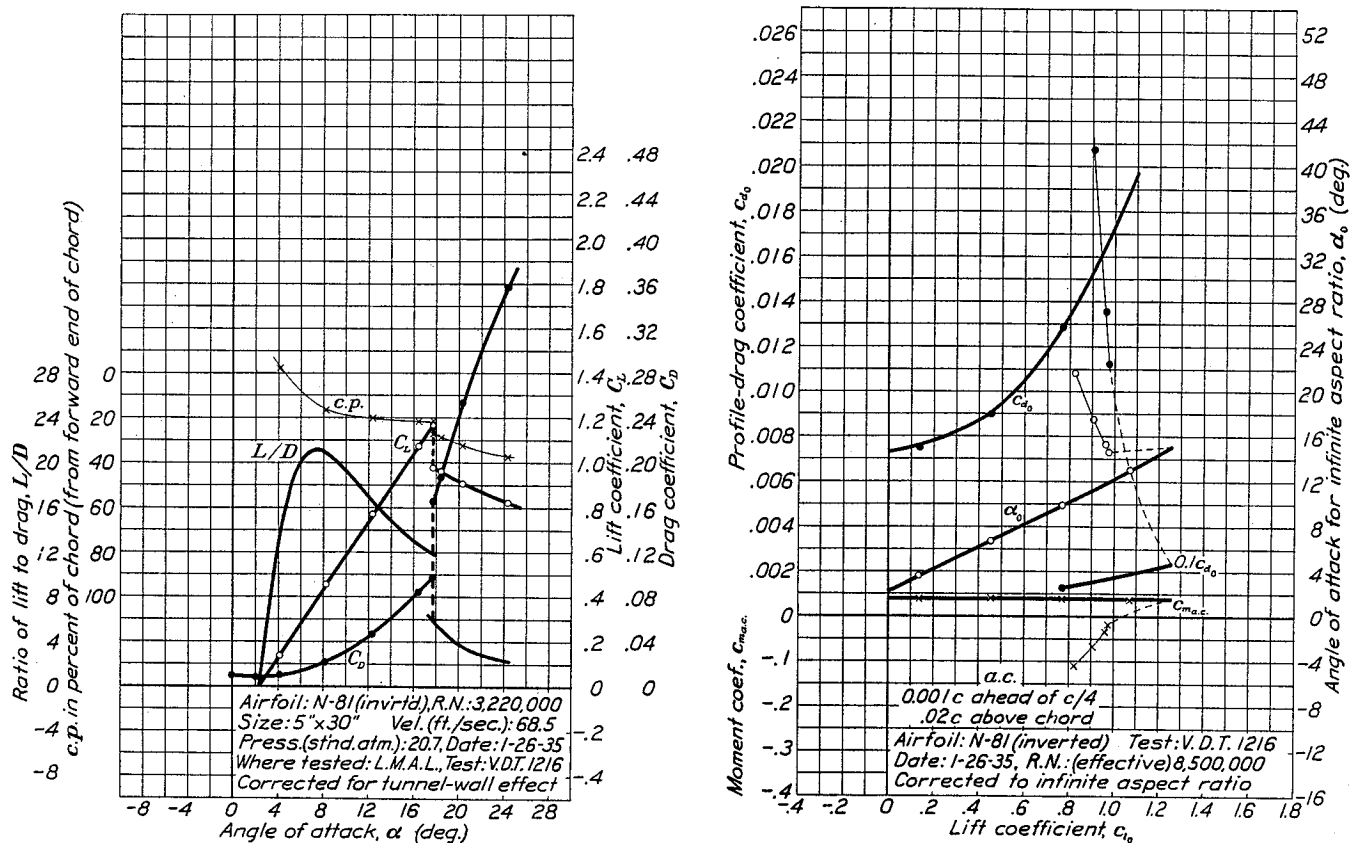


FIGURE 43.—N-81 airfoil (inverted).

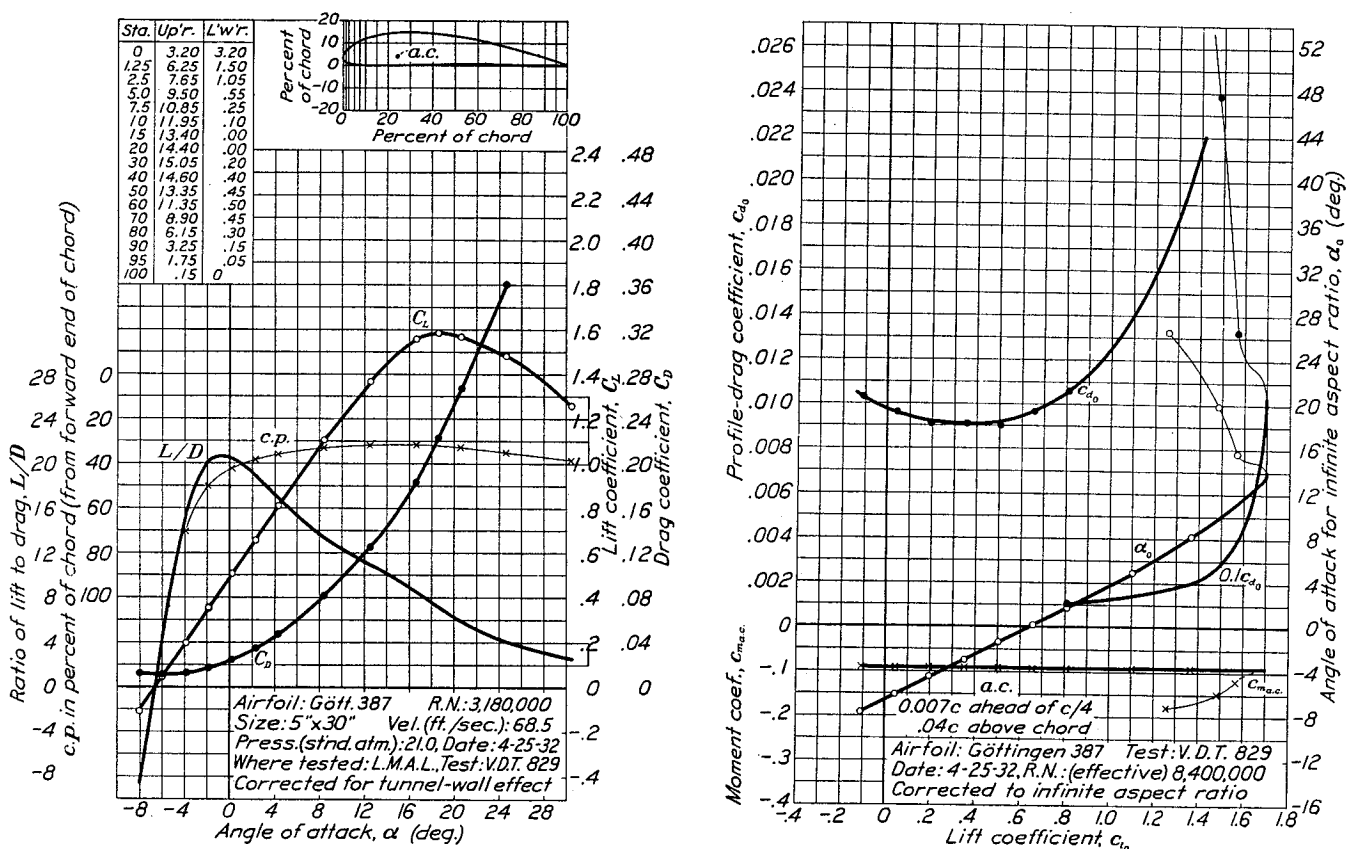


FIGURE 44.—Göttingen 387 airfoil.

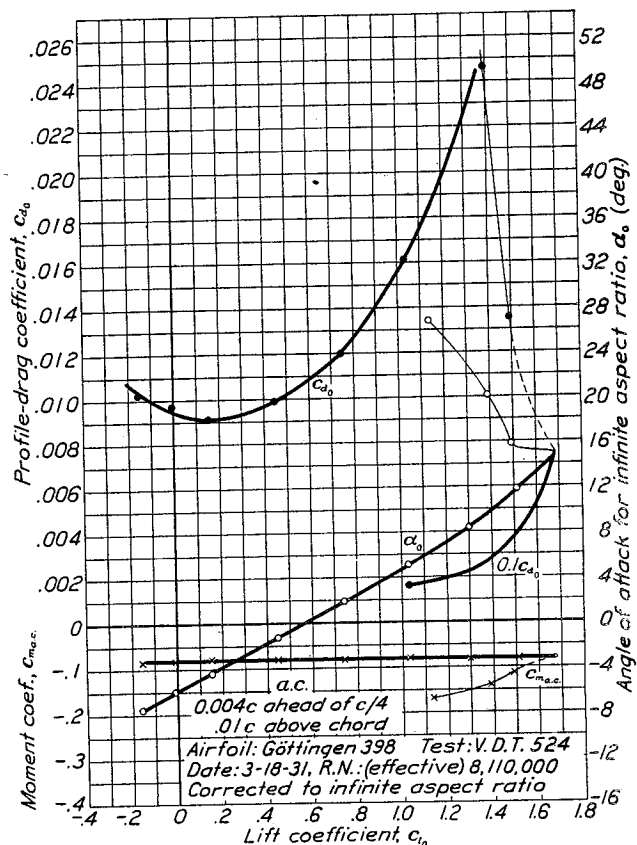
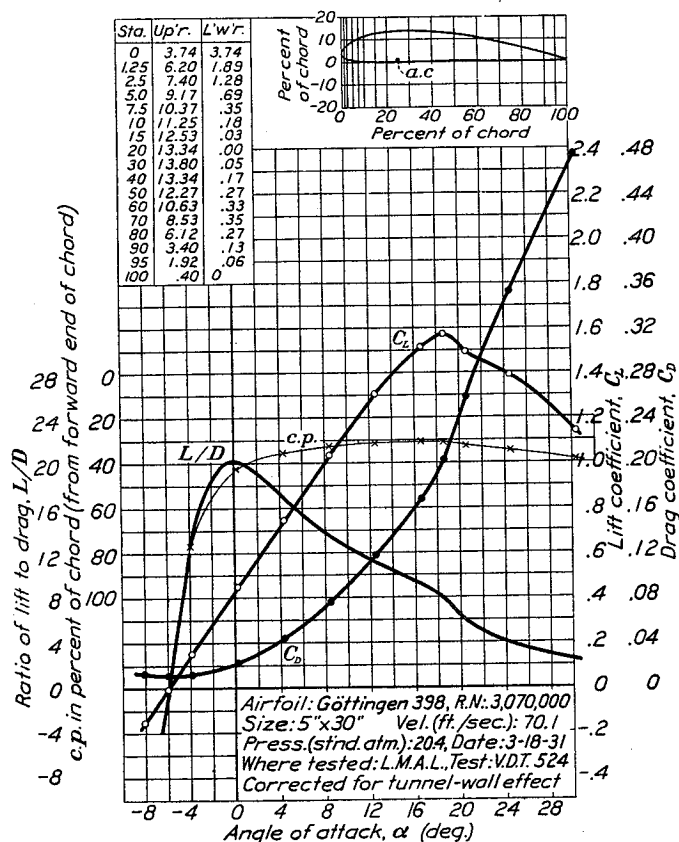


FIGURE 45.—Göttingen 398 airfoil.

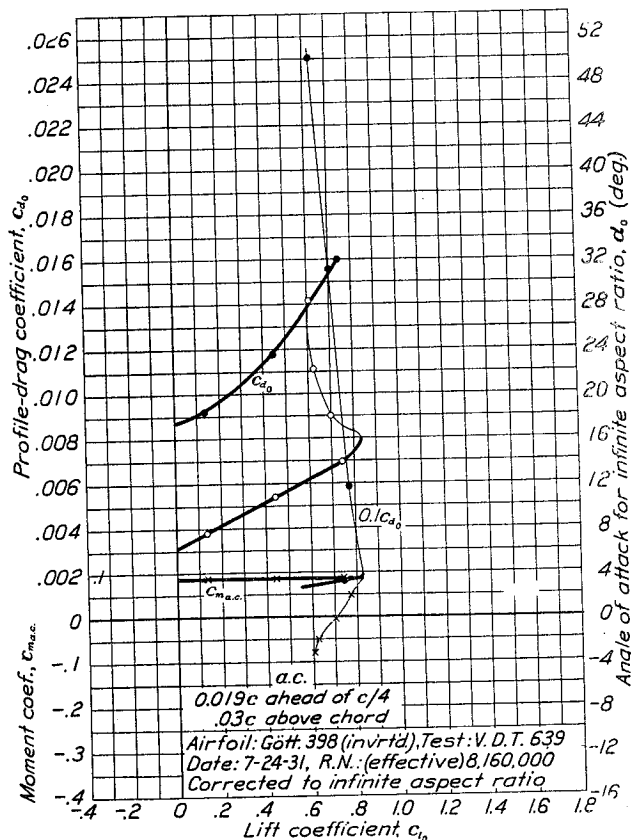
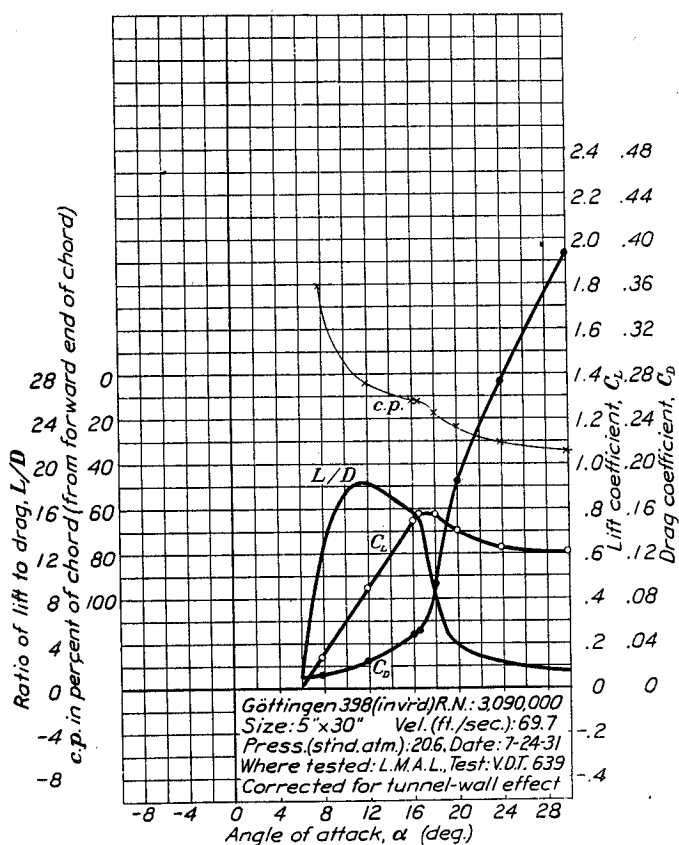


FIGURE 46.—Göttingen 398 airfoil (inverted).

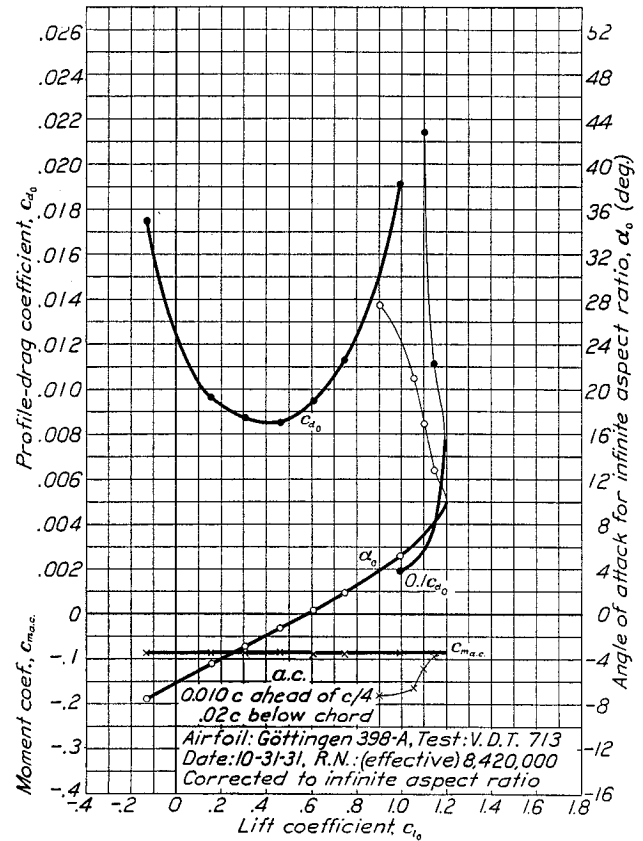
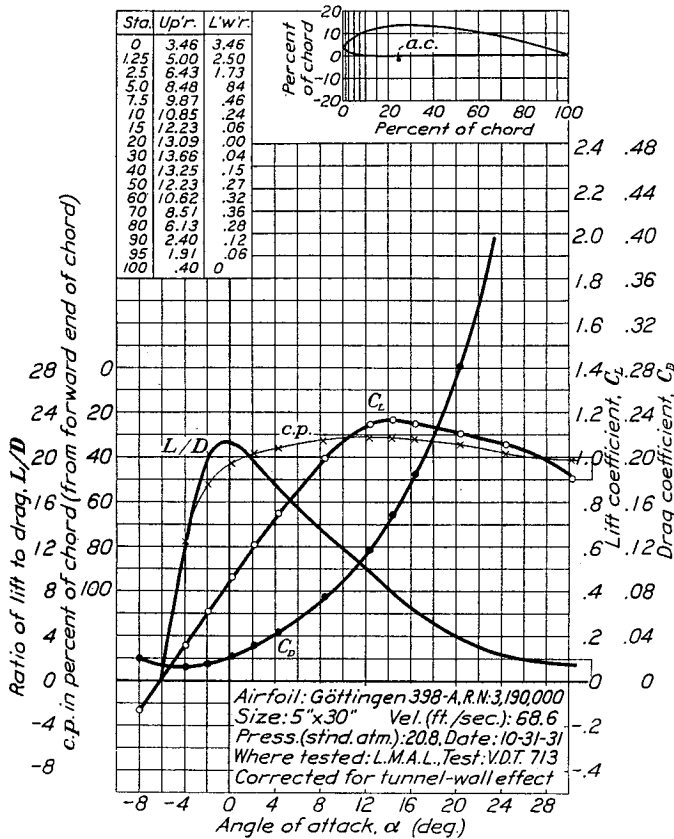


FIGURE 47.—Göttingen 398-A airfoil.

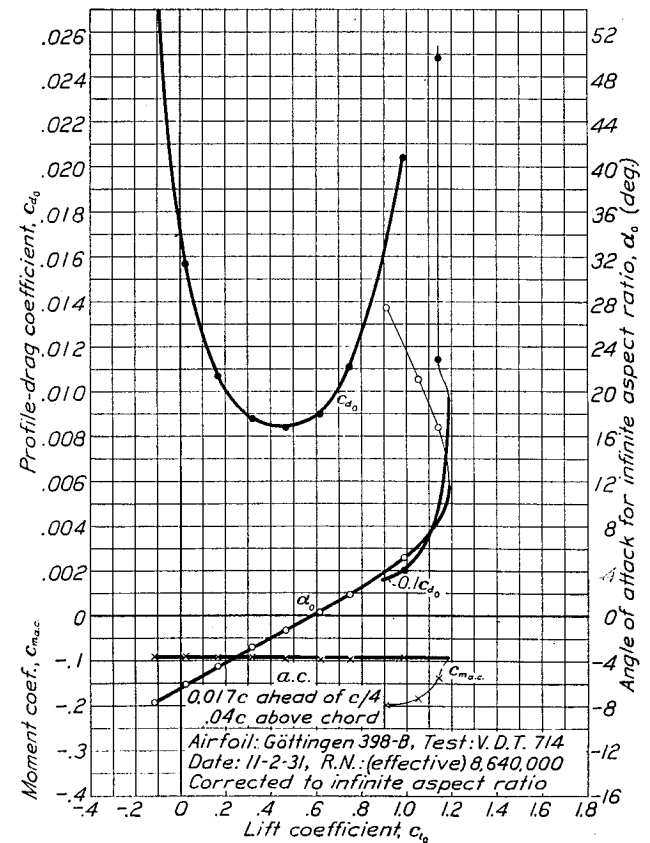
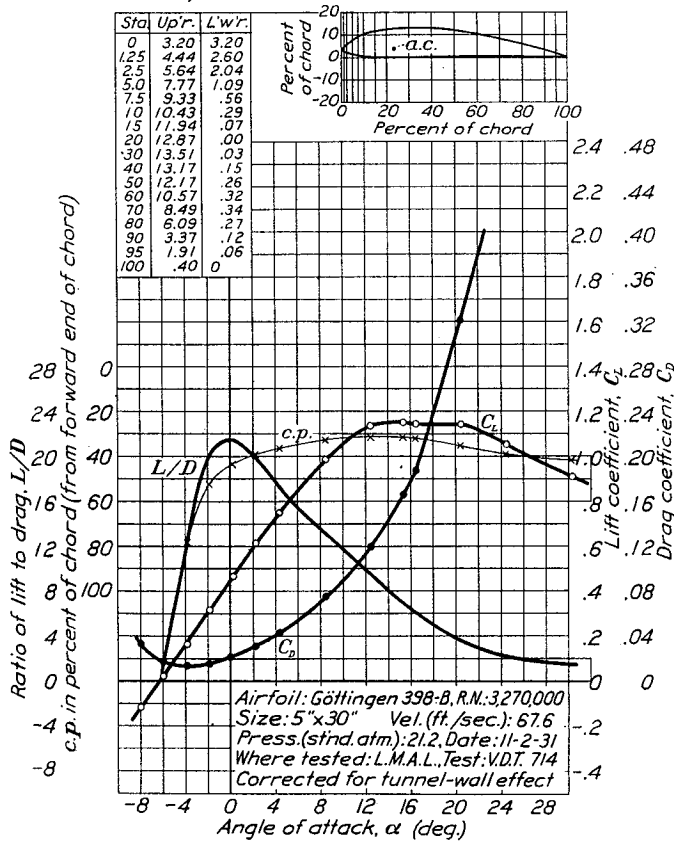


FIGURE 48.—Göttingen 398-B airfoil.

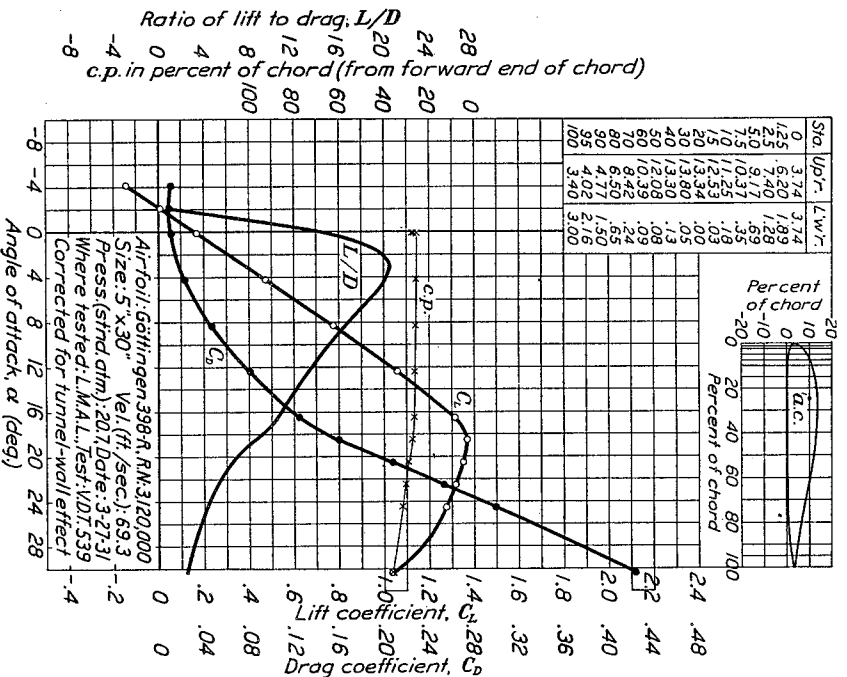


Figure 49.—Göttingen 398-R airfoil.

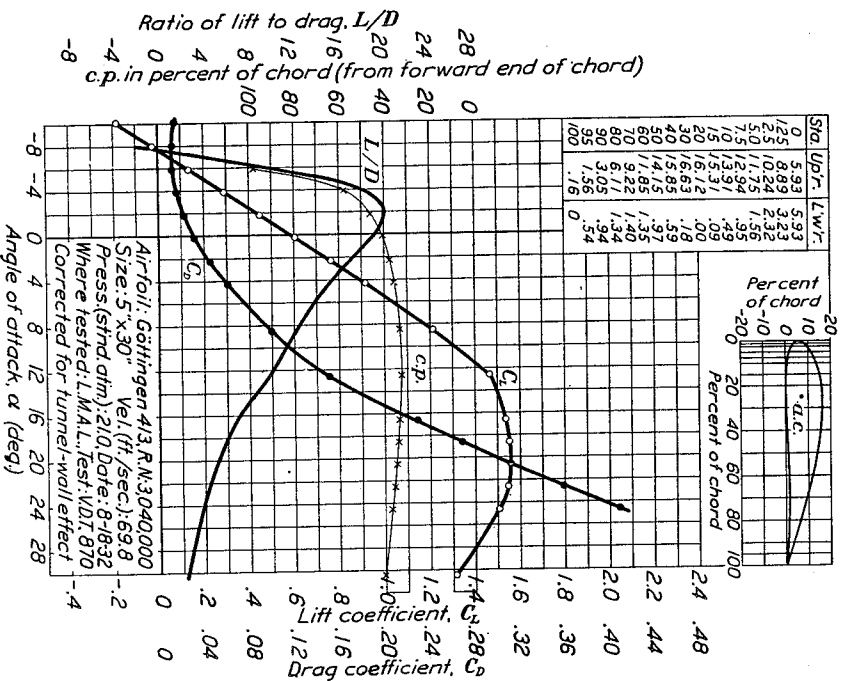
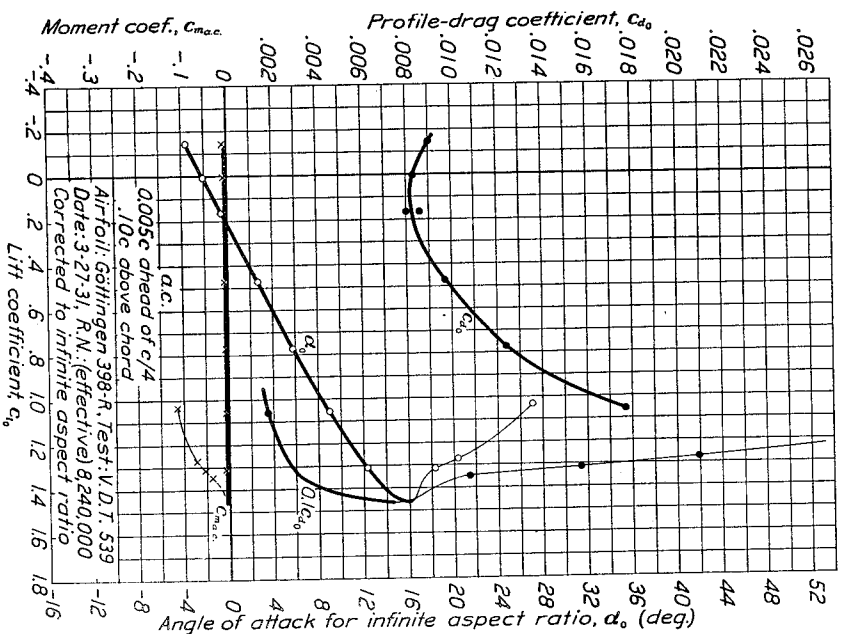


Figure 50.—Göttingen 413 airfoil.



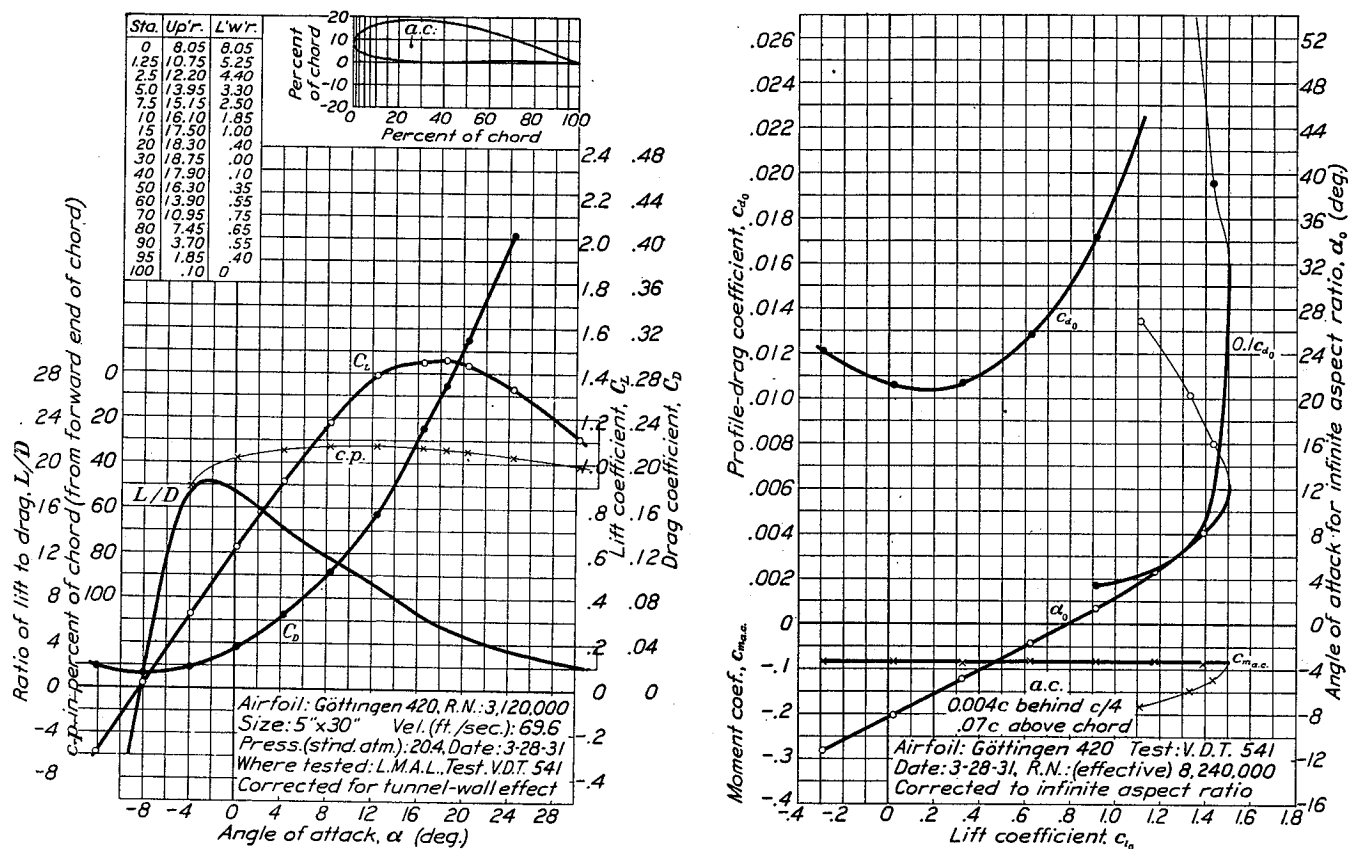


FIGURE 51.—Göttingen 420 airfoil.

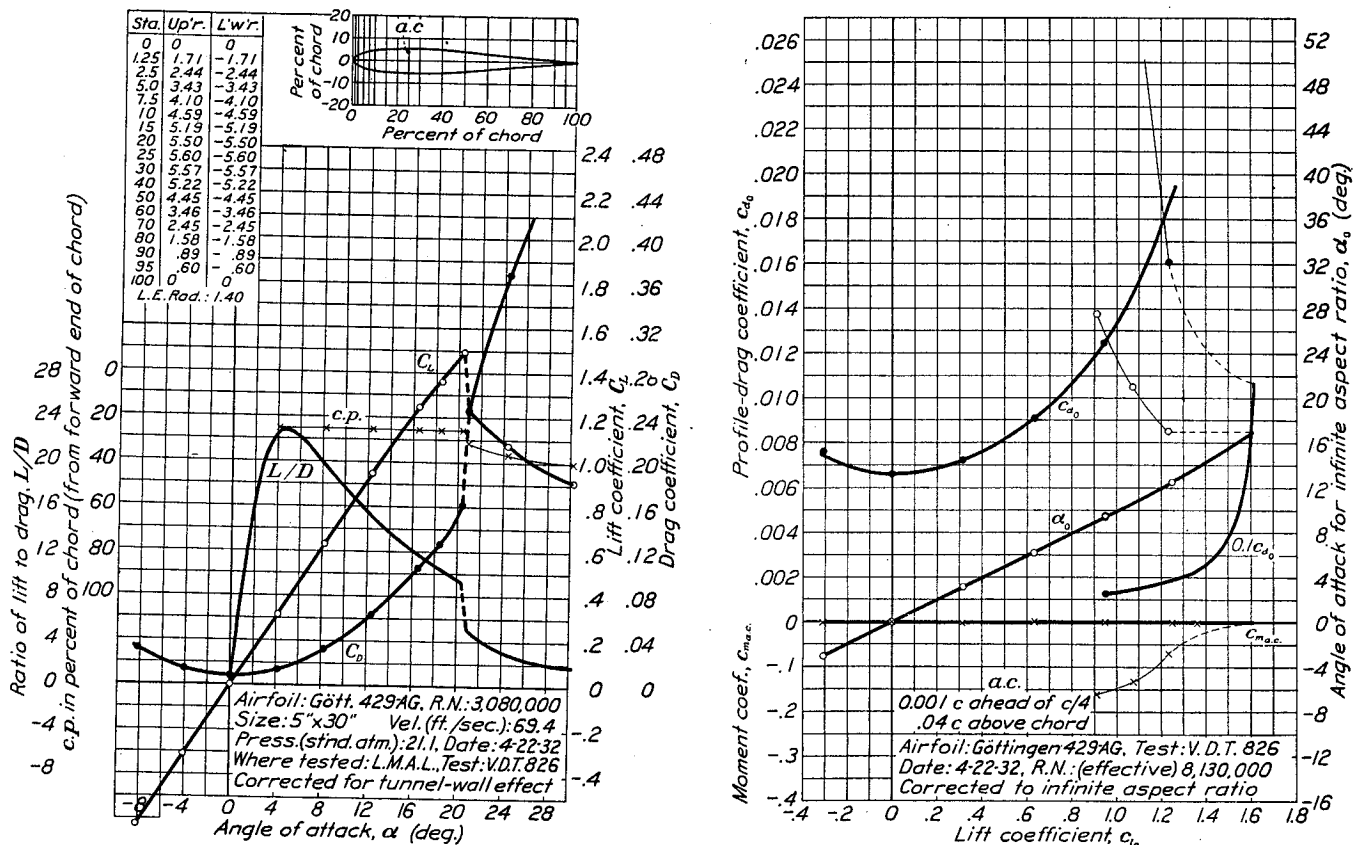


FIGURE 52.—Göttingen 429-AG airfoil.

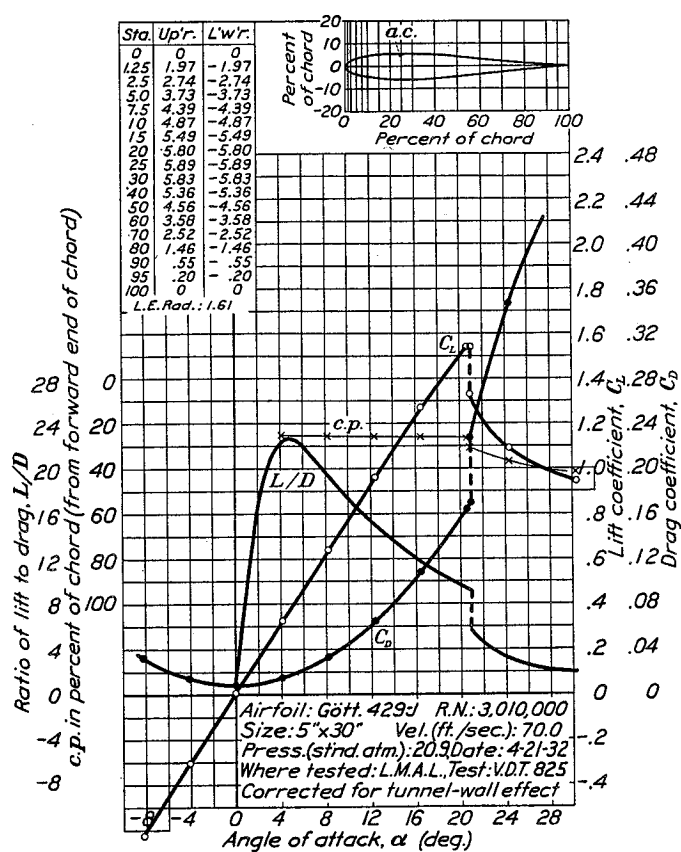


FIGURE 53.—Göttingen 429-J airfoil.

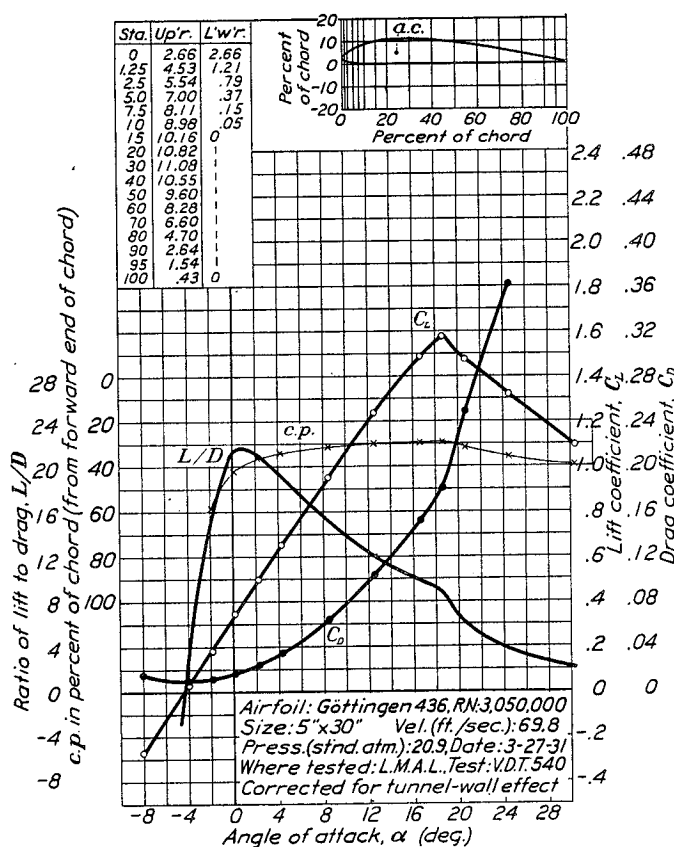
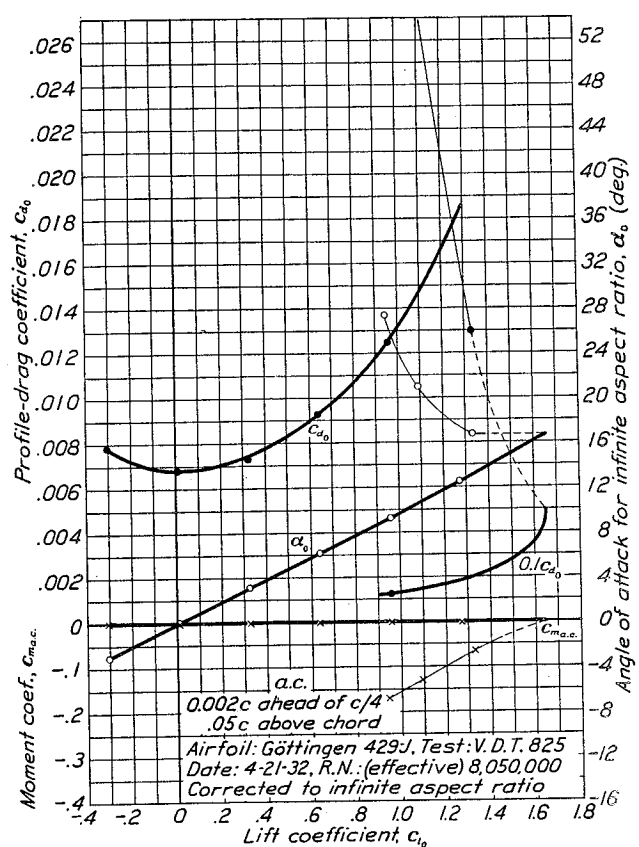
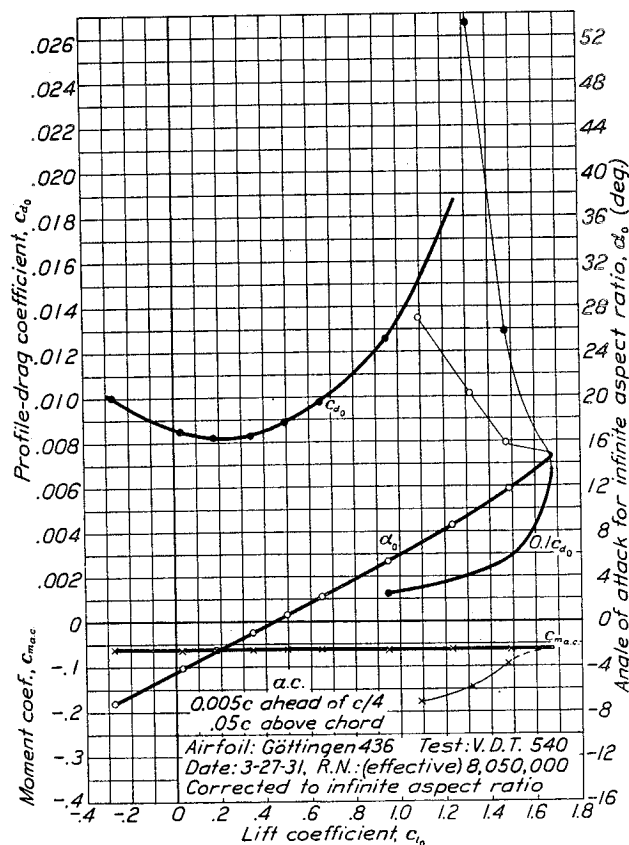


FIGURE 54.—Göttingen 436 airfoil.



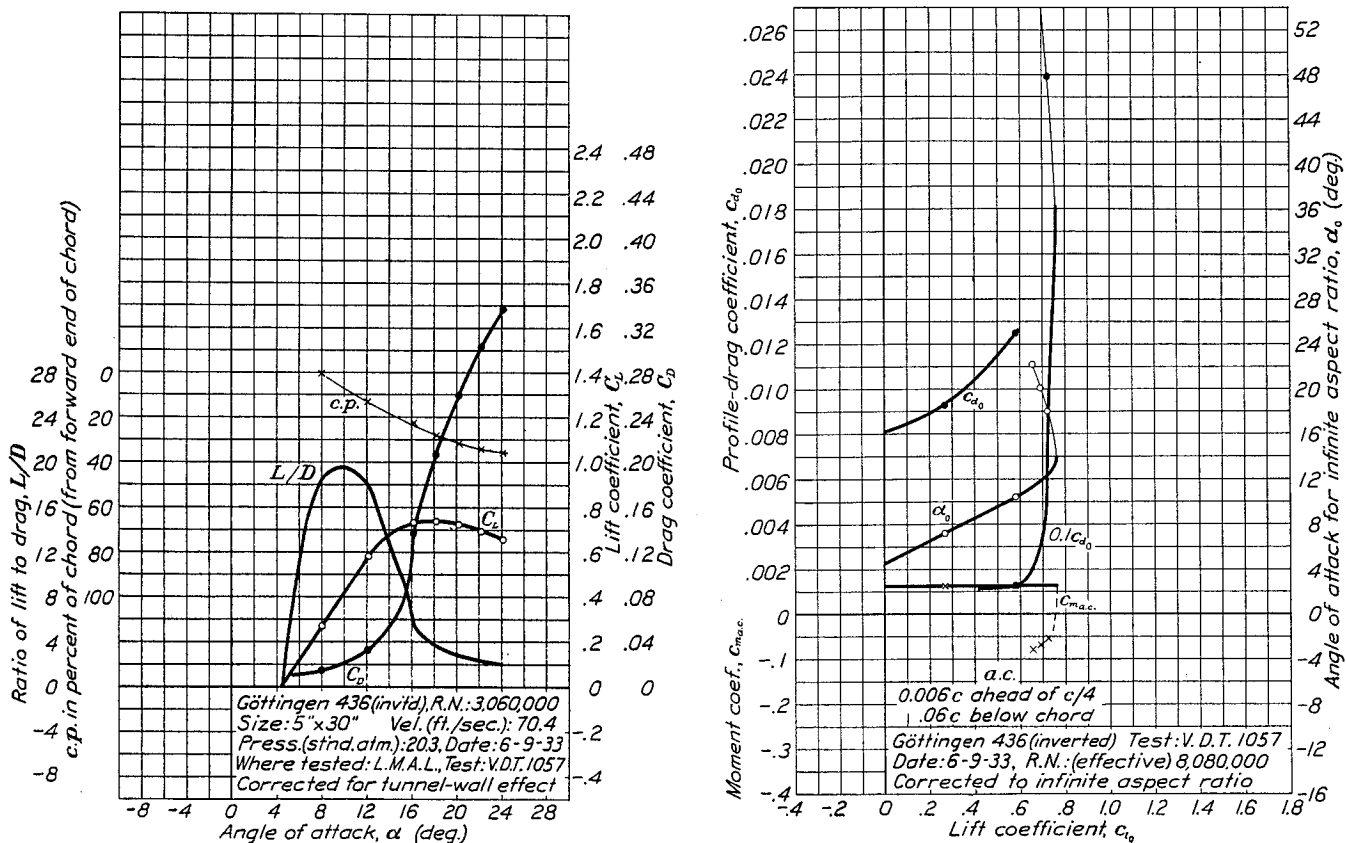


FIGURE 55.—Göttingen 436 airfoil (inverted).

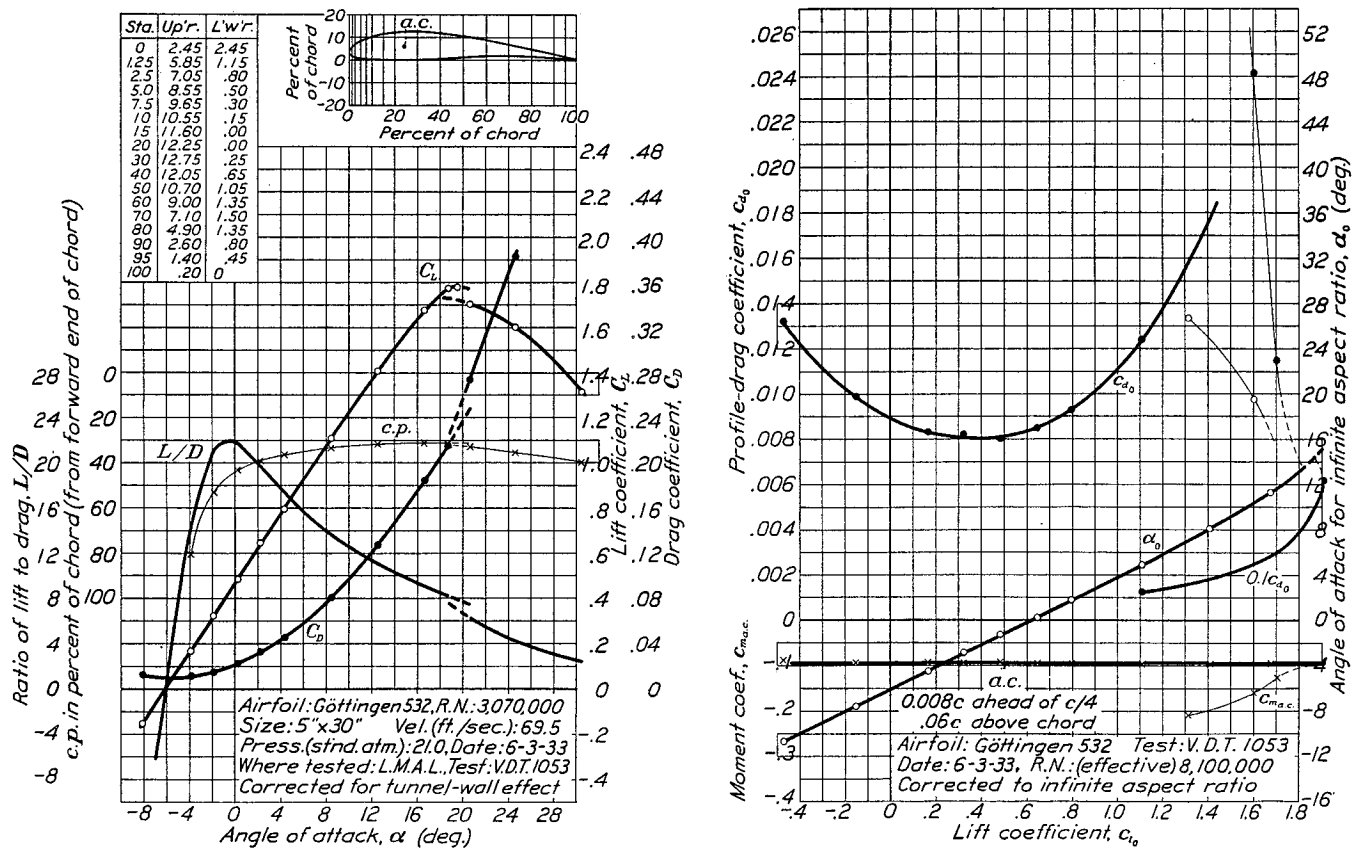


FIGURE 56.—Göttingen 532 airfoil.

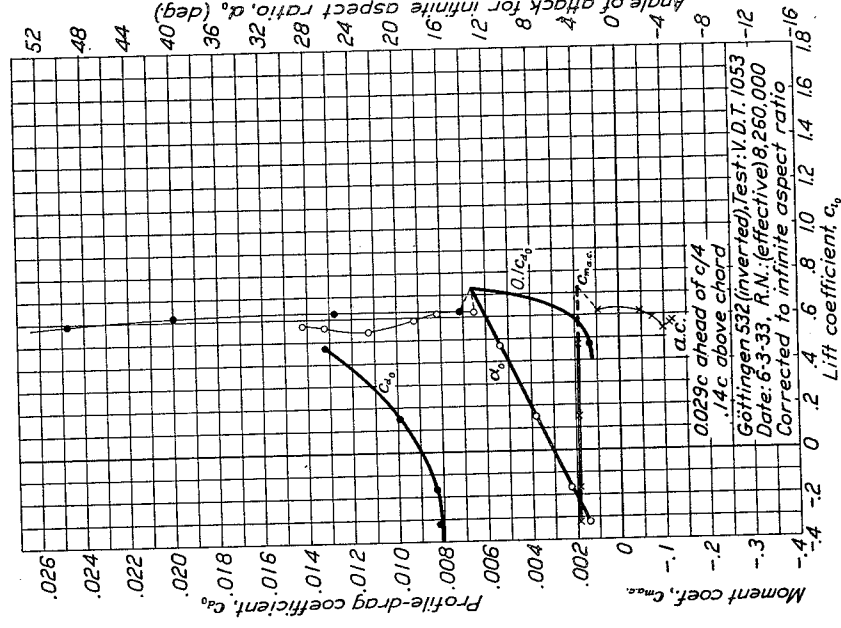
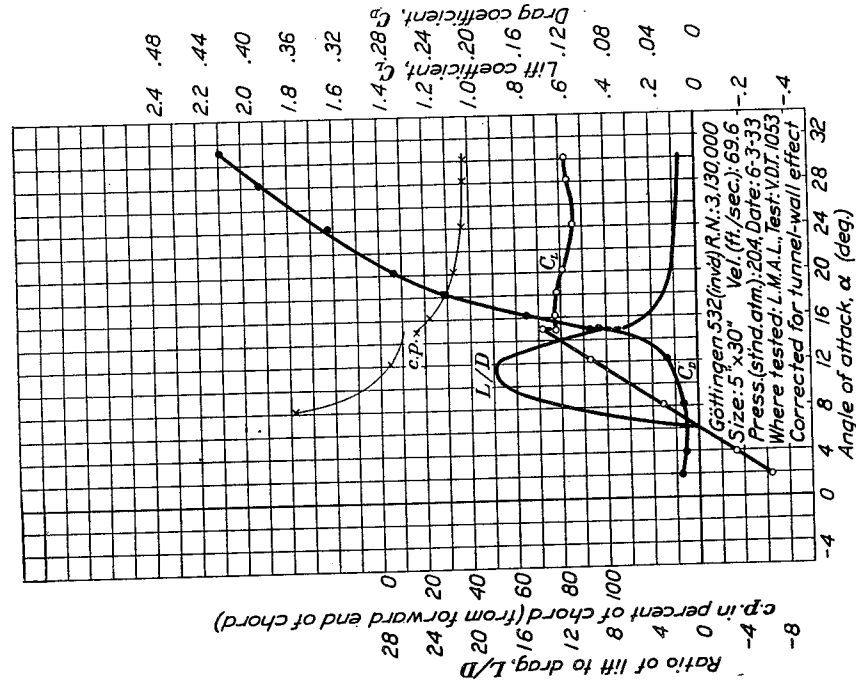


FIGURE 57.—Göttingen 532 airfoil (inverted).

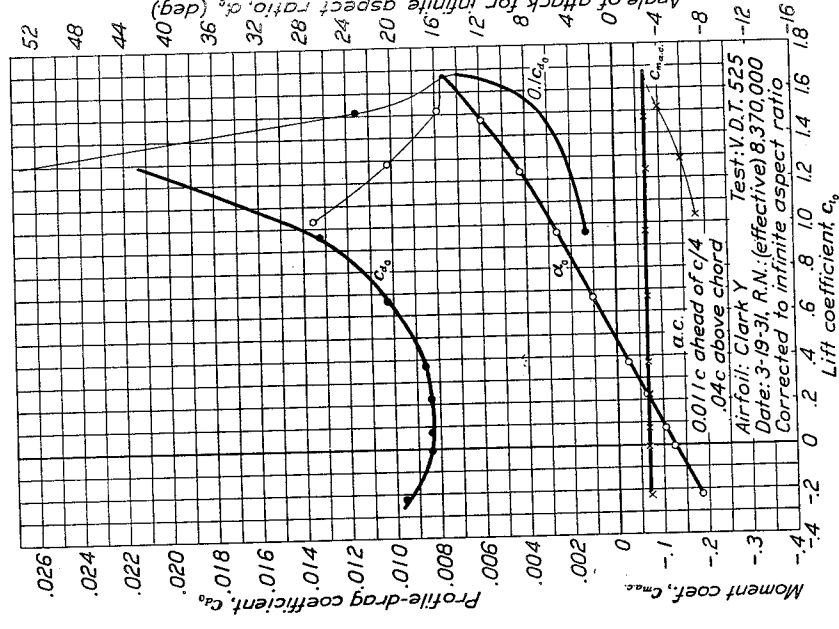
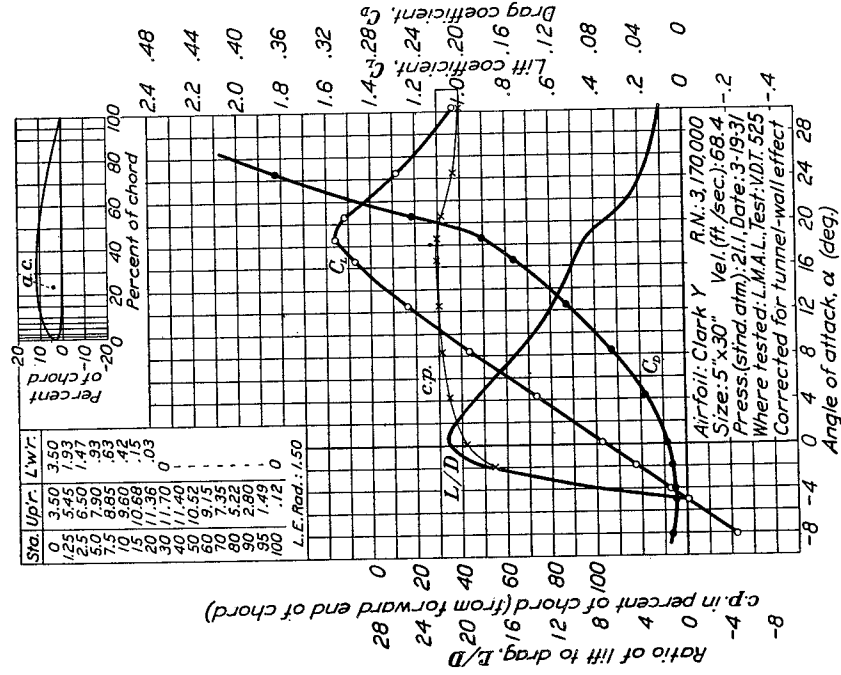


FIGURE 58.—Clark Y airfoil.

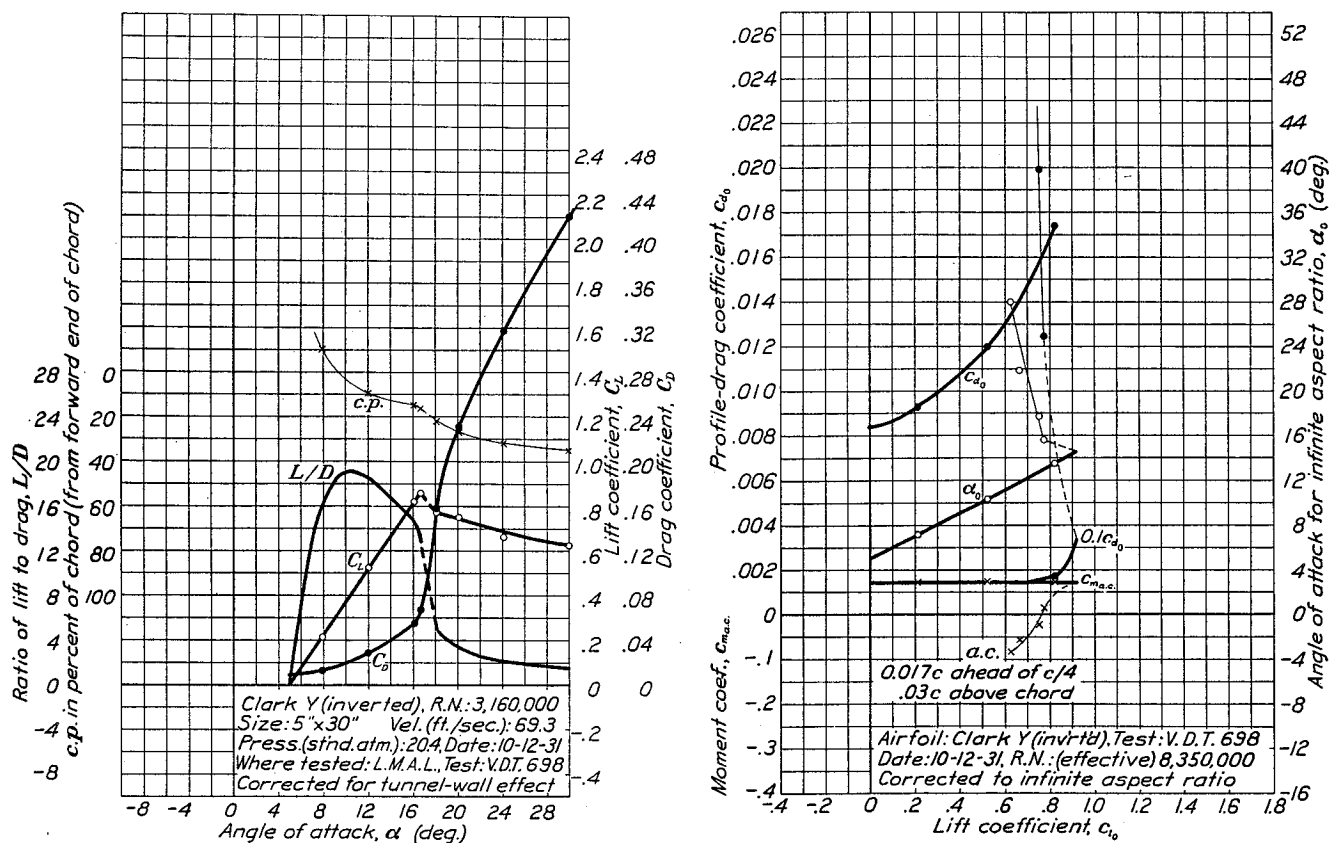


FIGURE 59.—Clark Y airfoil (inverted).

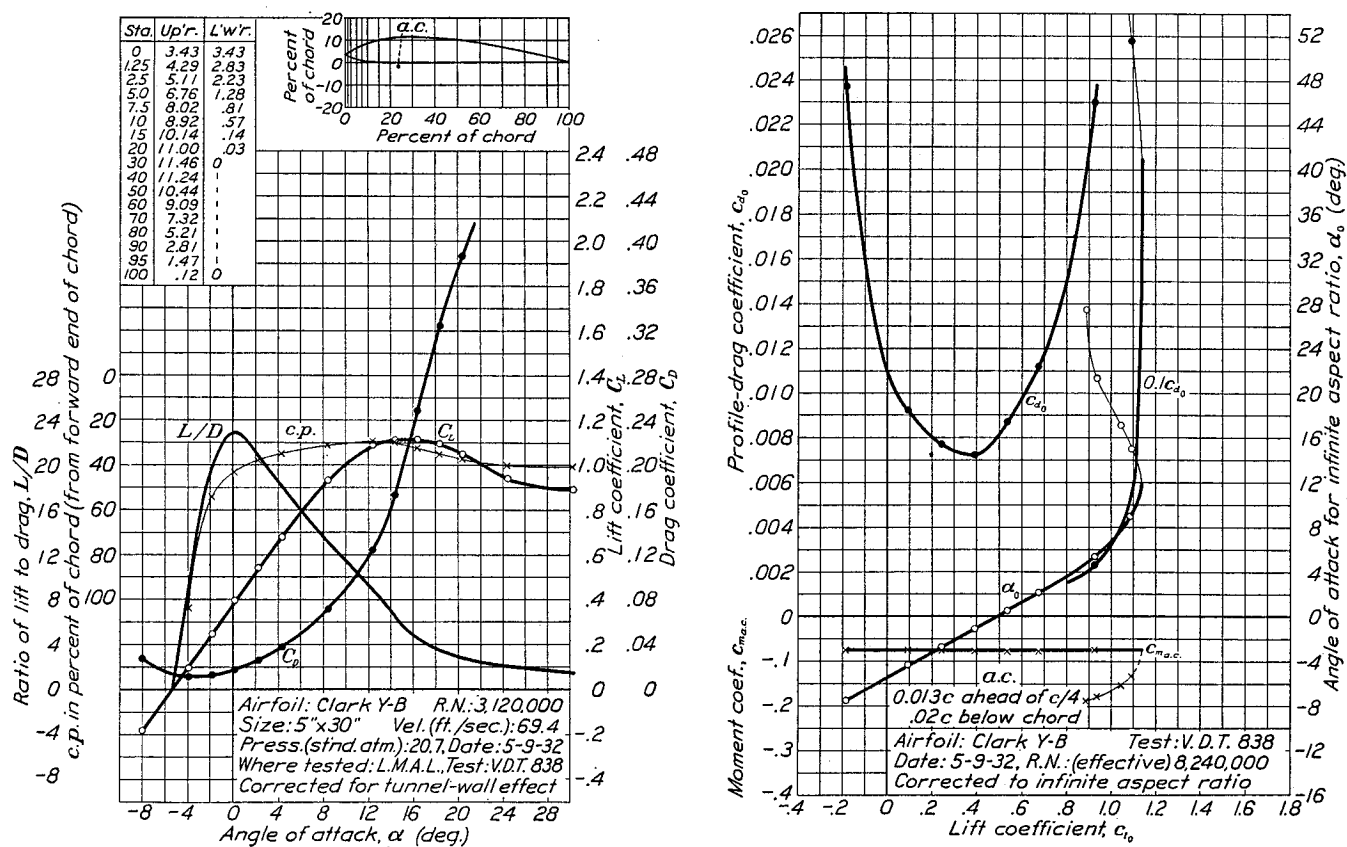


FIGURE 60.—Clark Y-B airfoil.

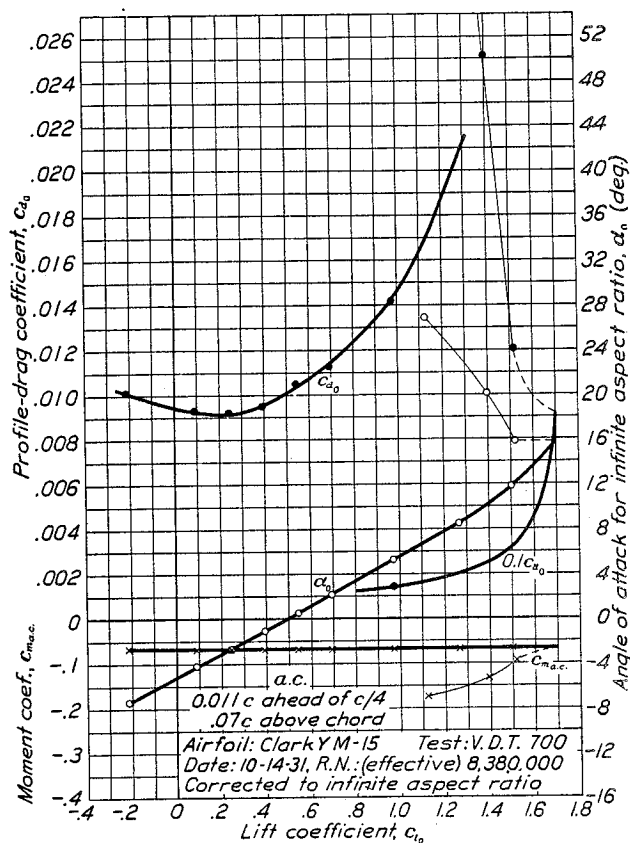
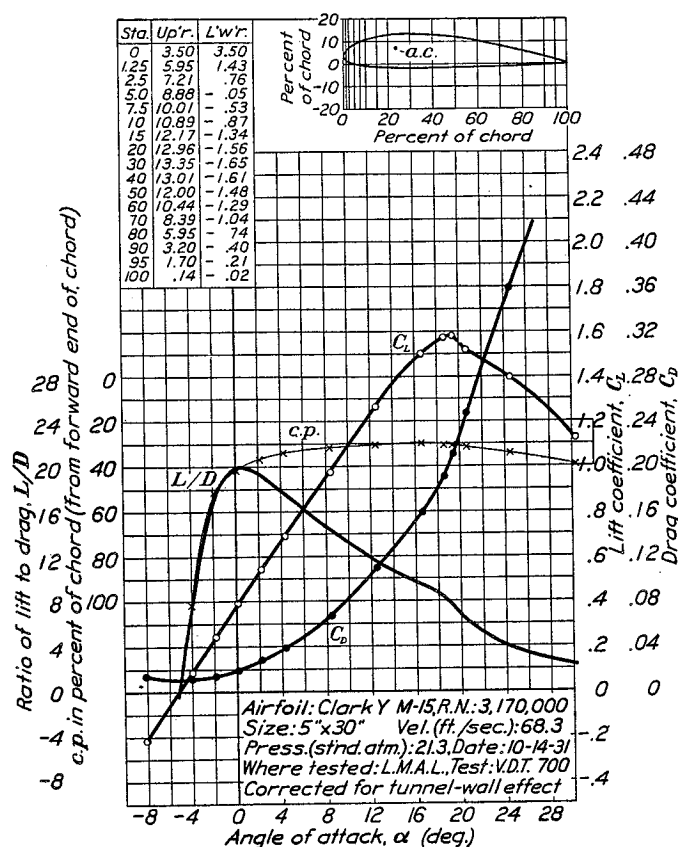


FIGURE 61.—Clark Y M-15 airfoil.

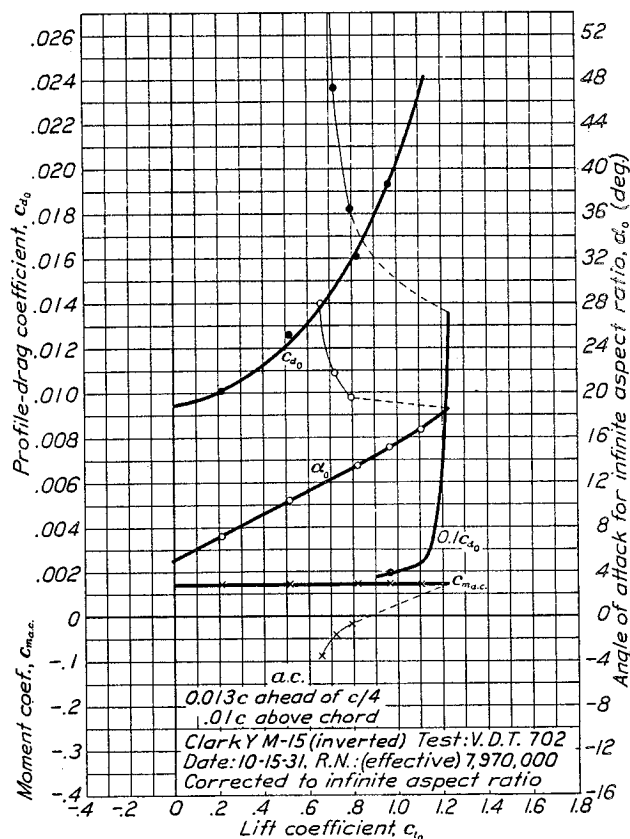
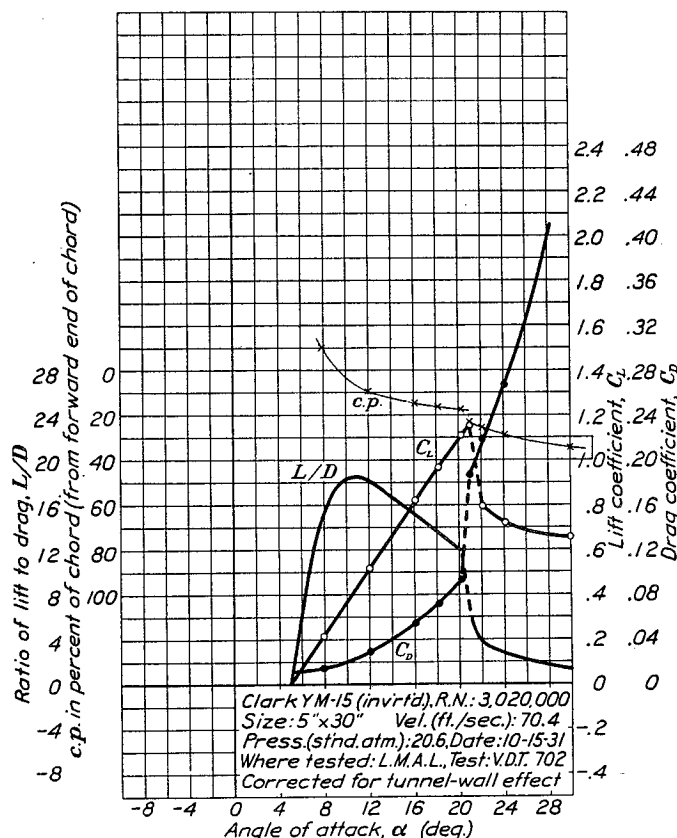


FIGURE 62.—Clark Y M-15 airfoil (inverted).

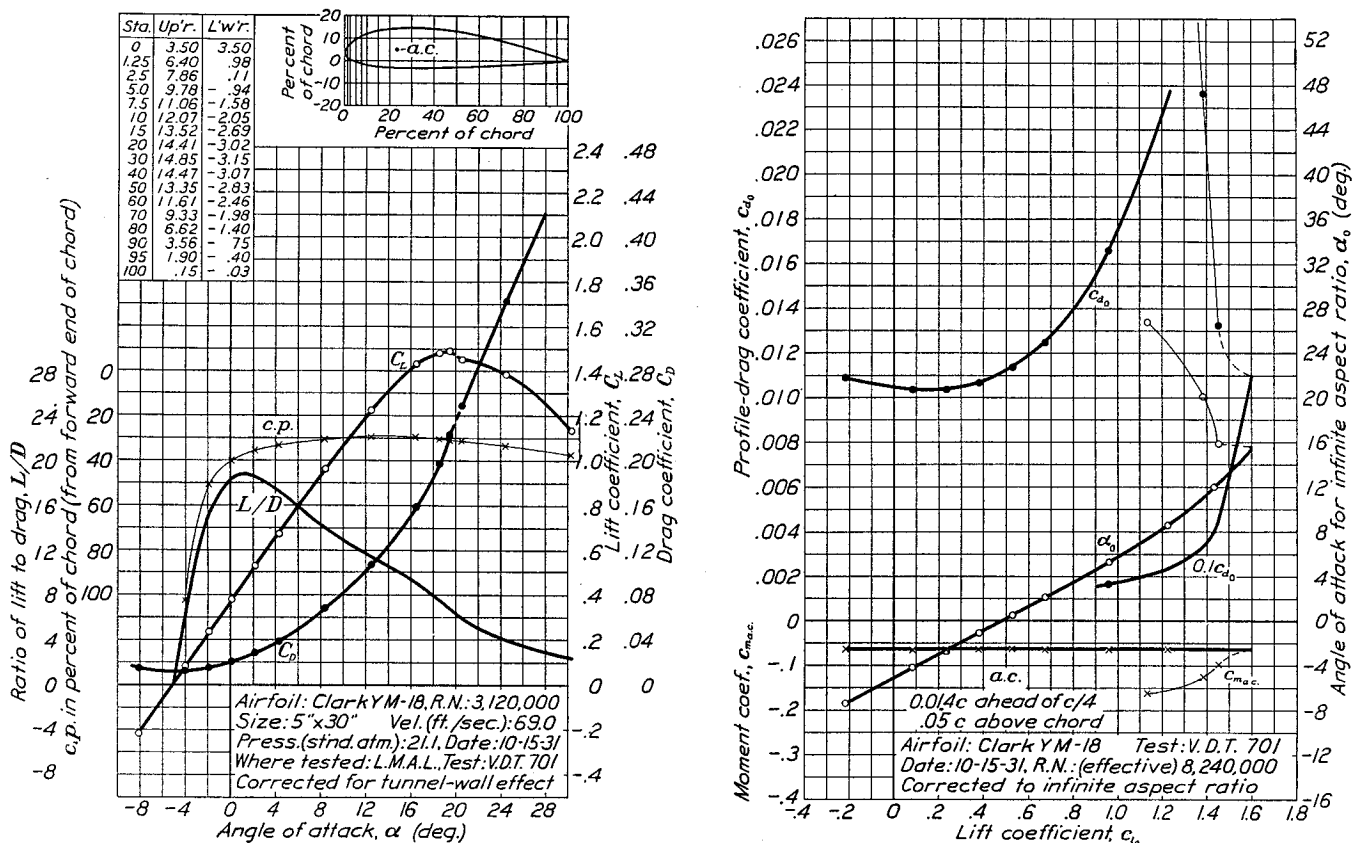


FIGURE 63.—Clark Y M-18 airfoil.

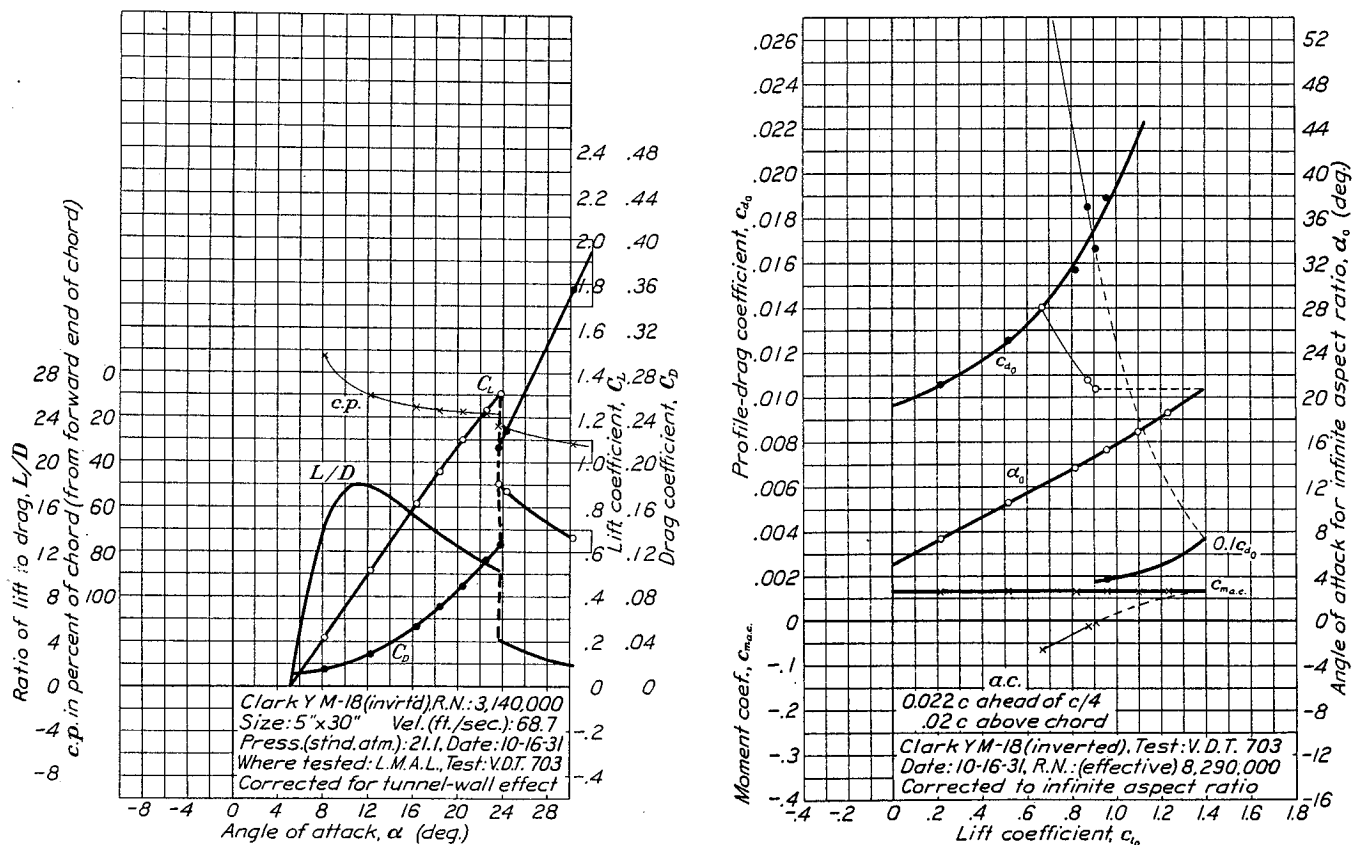


FIGURE 64.—Clark Y M-18 airfoil (inverted).

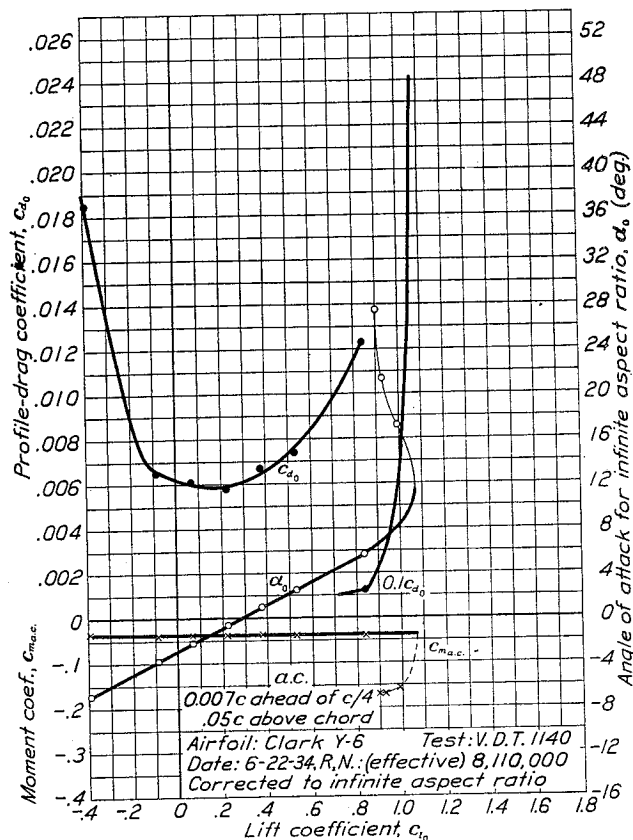
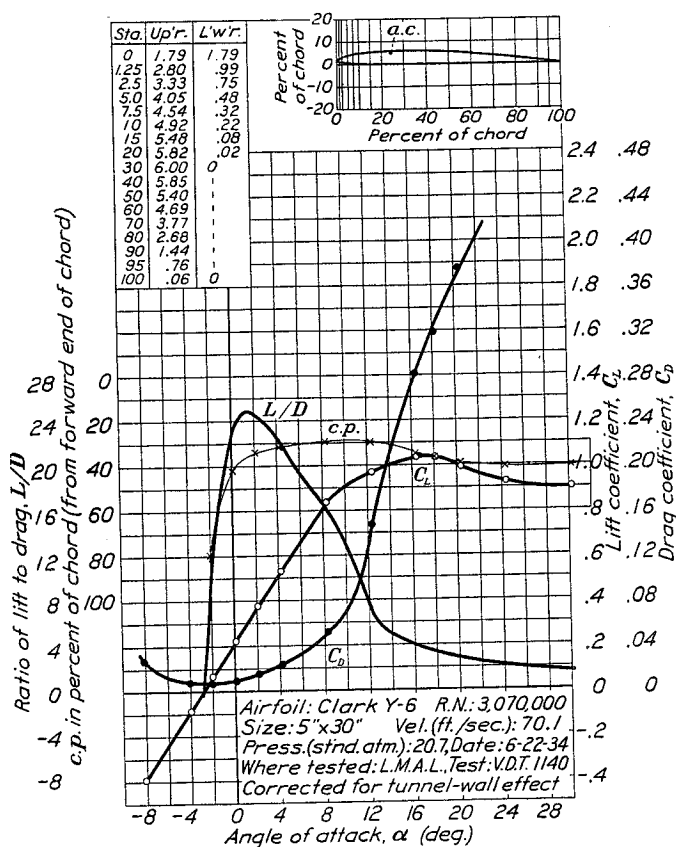


FIGURE 65.—Clark Y-6 airfoil.

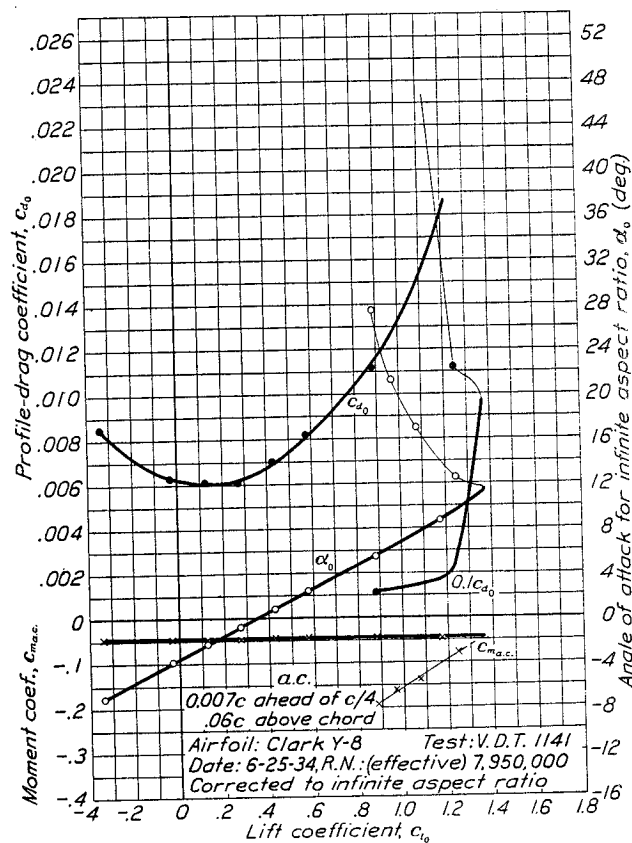
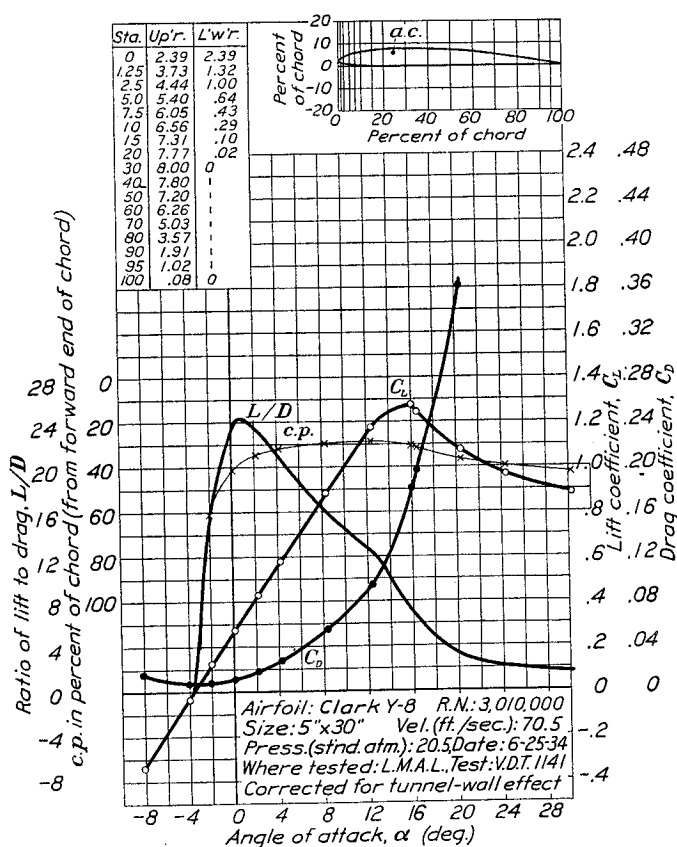


FIGURE 66.—Clark Y-8 airfoil.

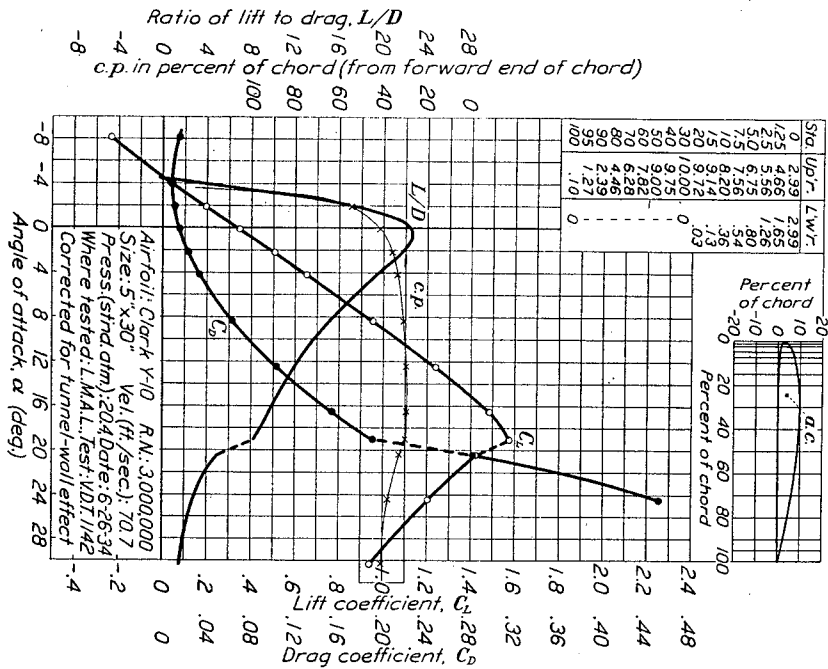


FIGURE 67.—Clark Y-10 airfoil.

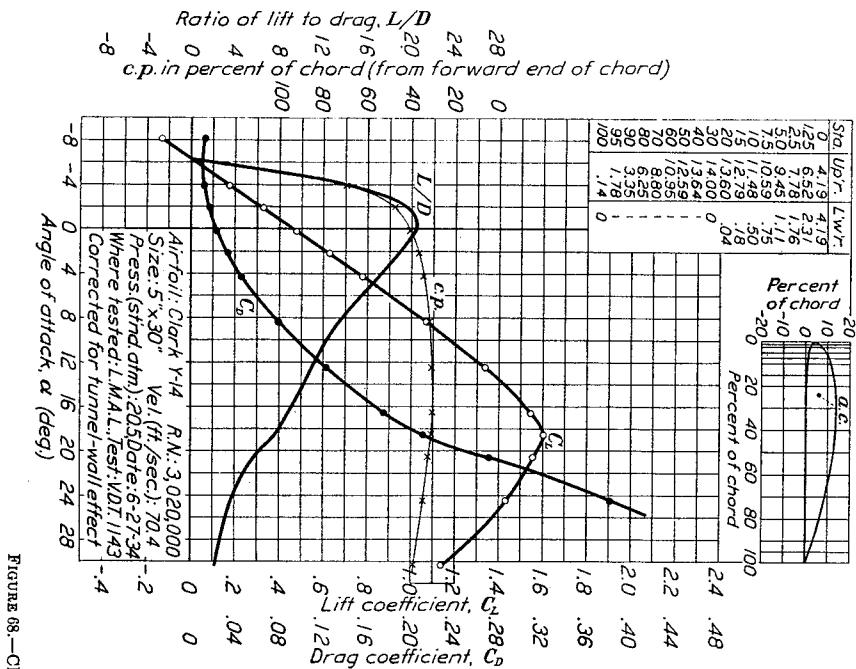
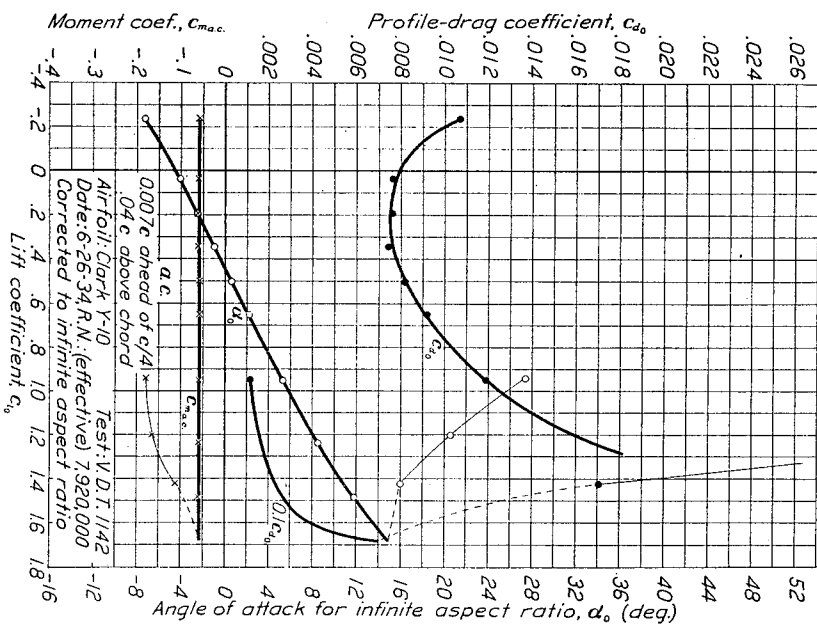


FIGURE 68.—Clark Y-14 airfoil.

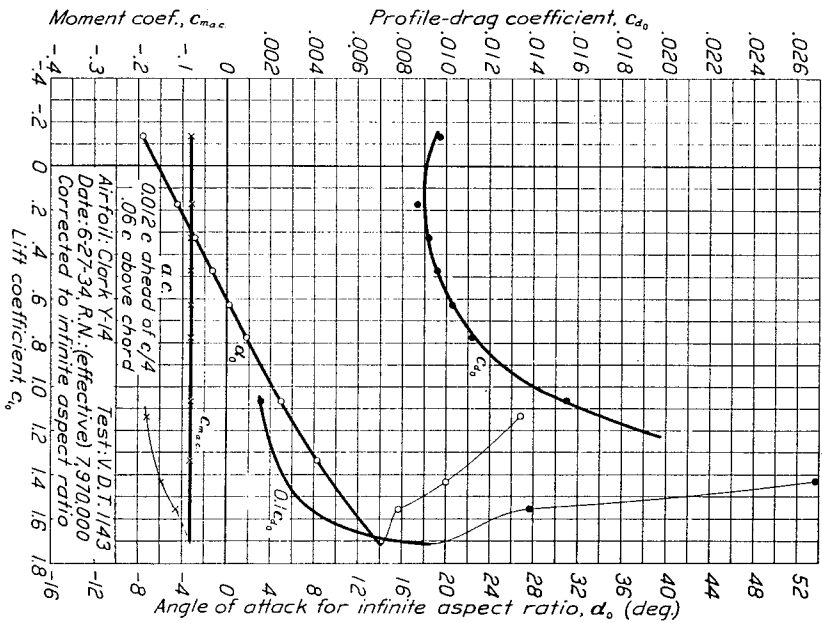


FIGURE 69.—Clark Y-14 airfoil.

CHARACTERISTICS OF AIRFOILS TESTED IN THE VARIABLE-DENSITY TUNNEL

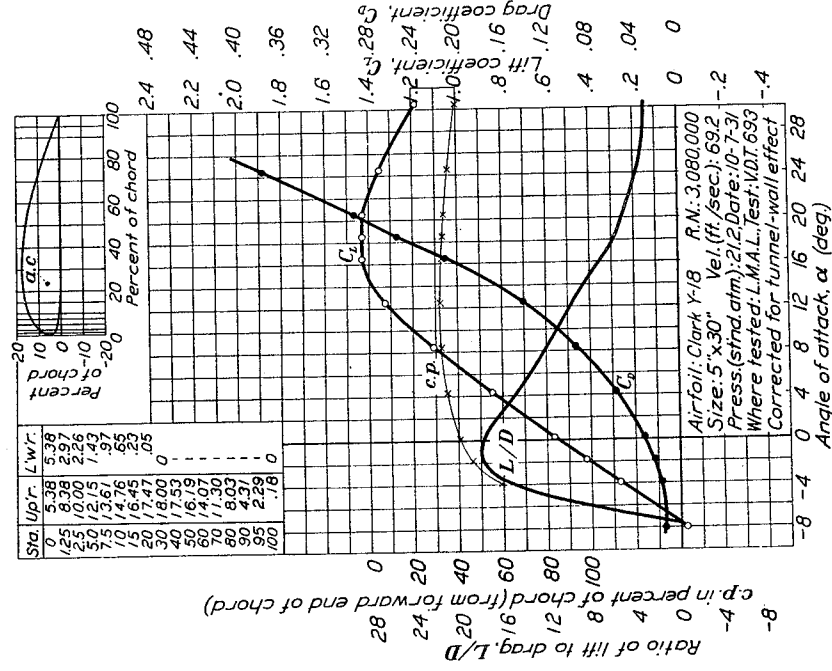


FIGURE 69.—Clark Y-18 airfoil.

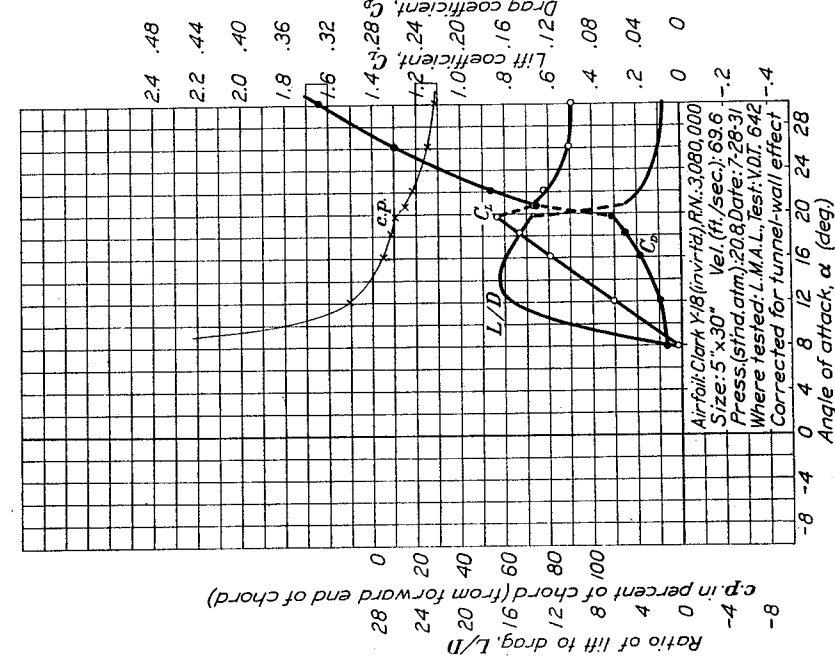
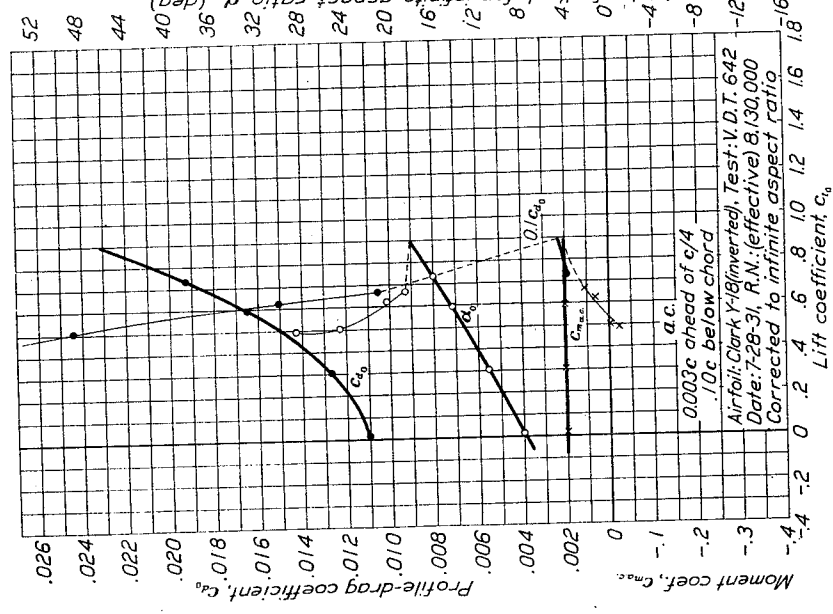
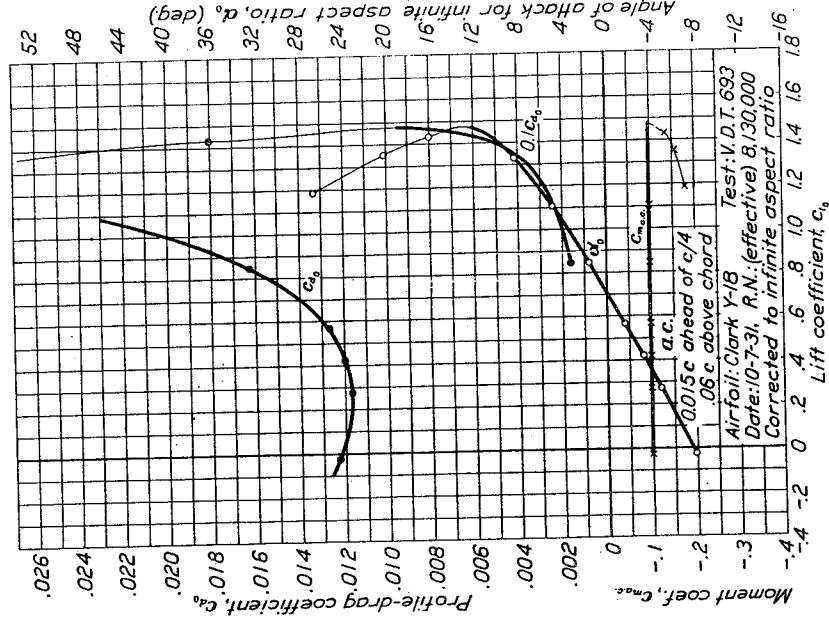


FIGURE 70.—Clark Y-18 airfoil (inverted).



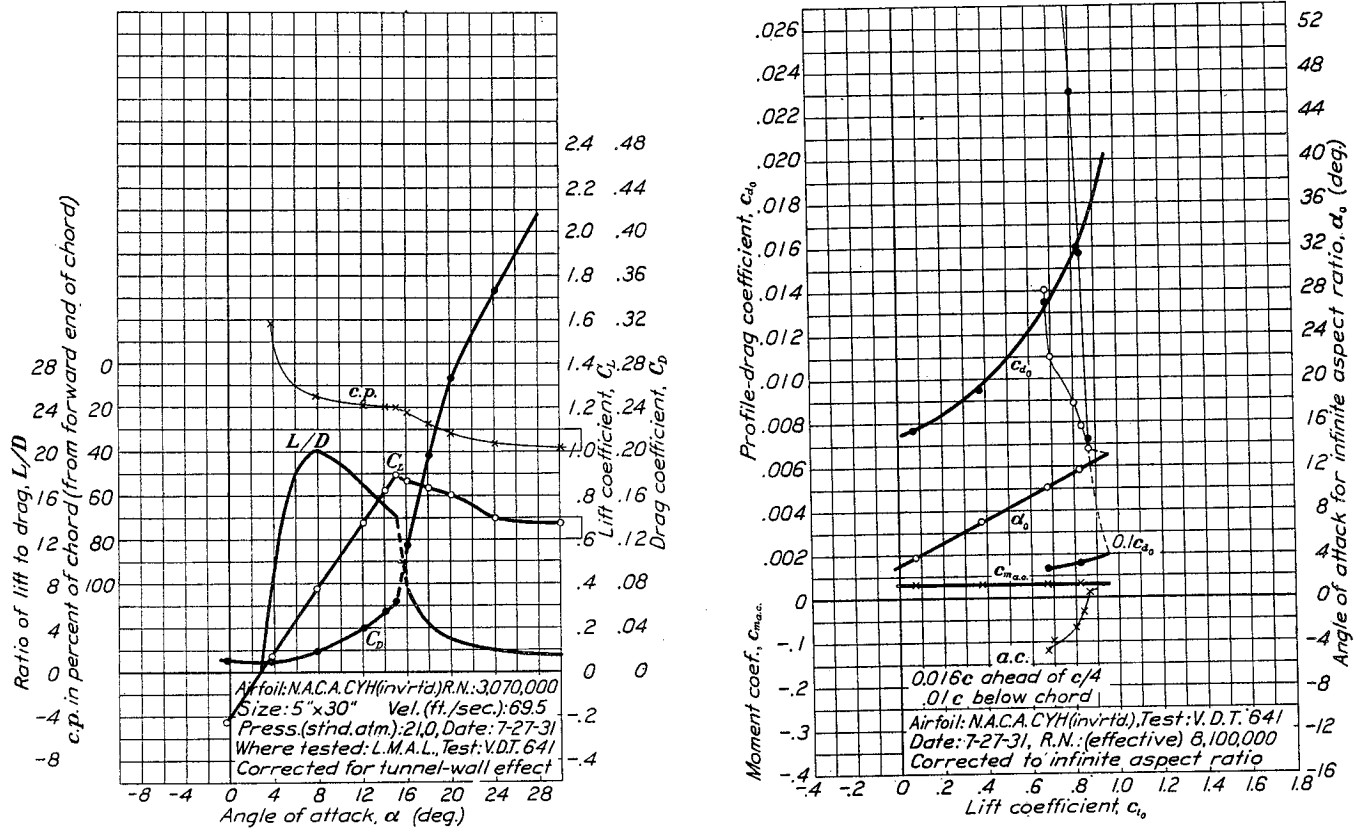


FIGURE 73.—N. A. C. A. CYH airfoil (inverted).

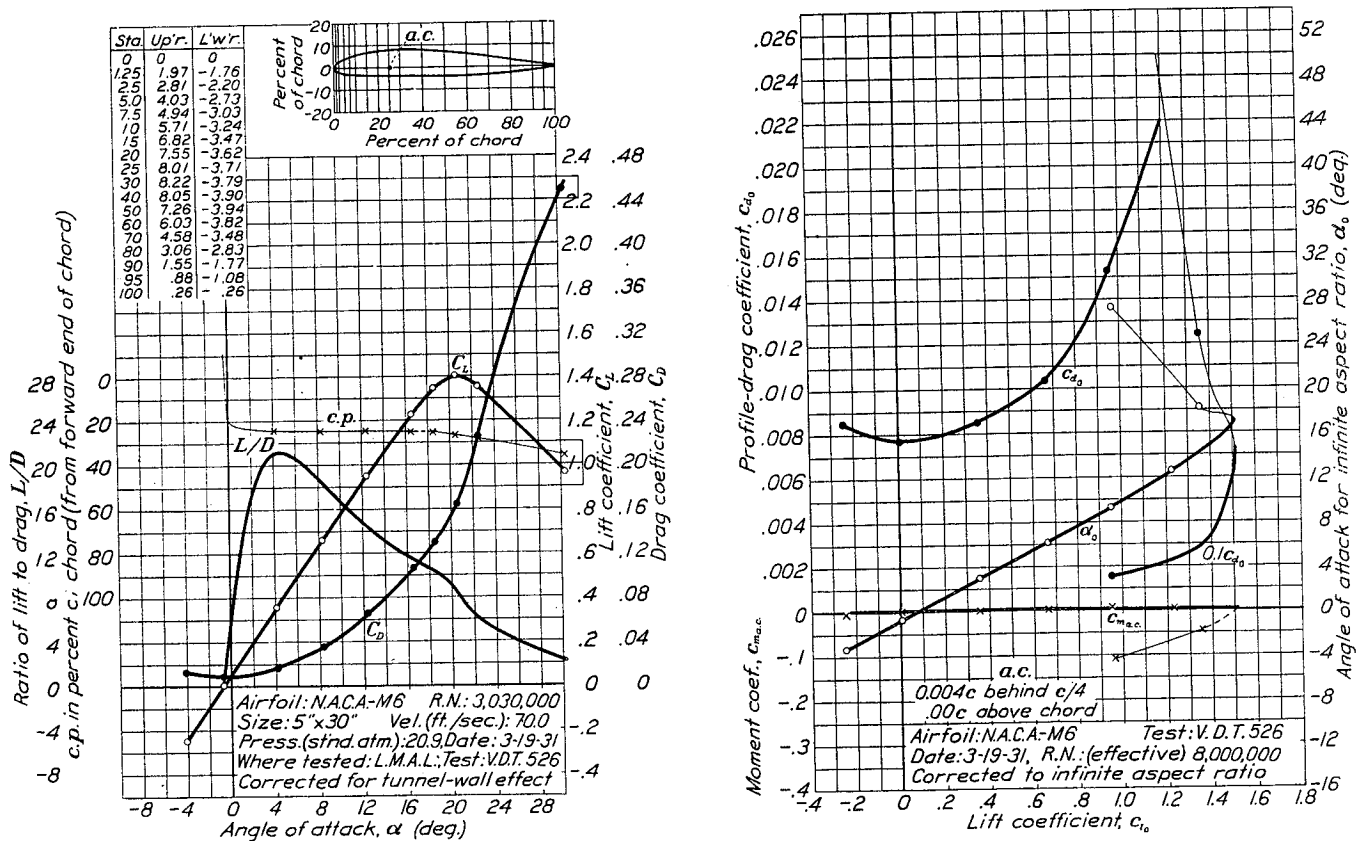


FIGURE 74.—N. A. C. A. -M6 airfoil.

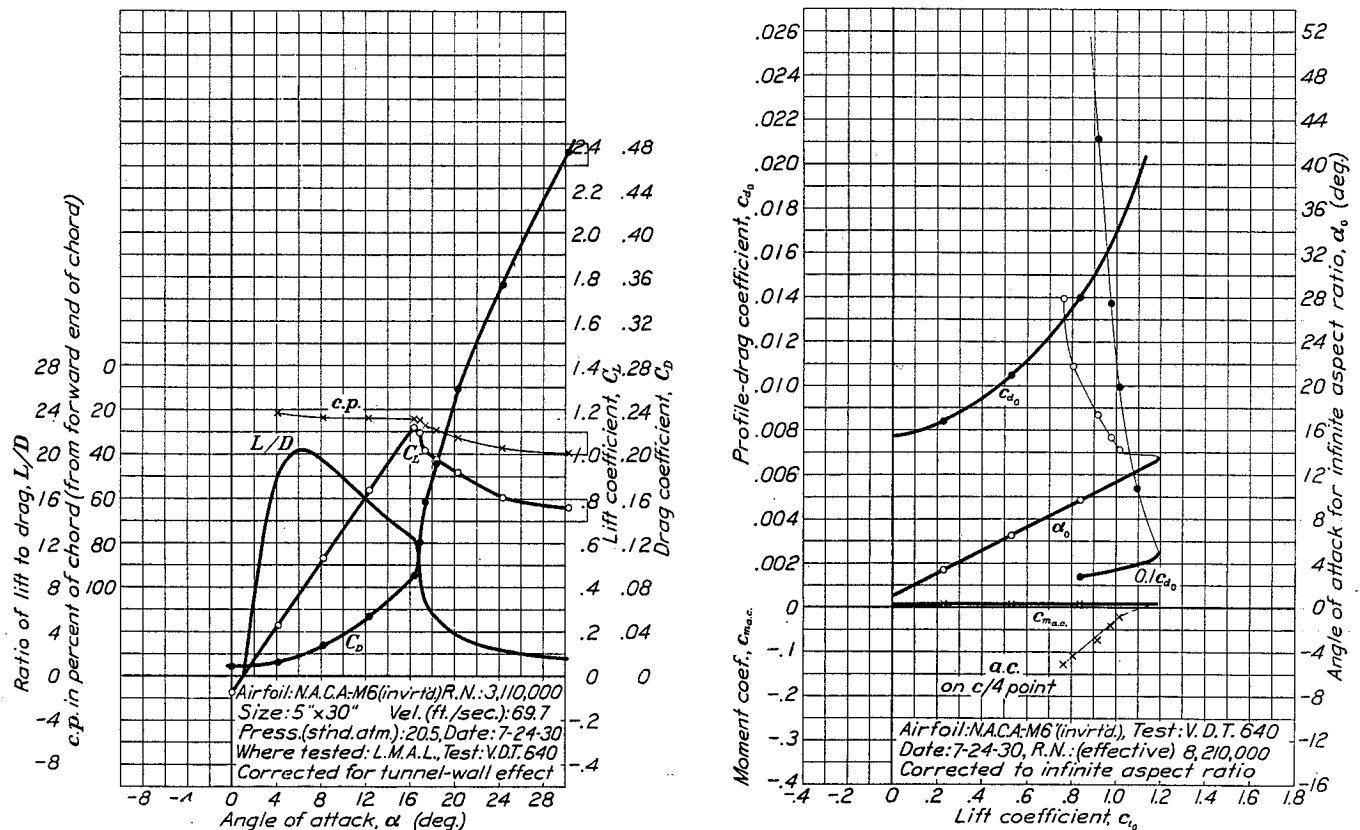


FIGURE 75.—N. A. C. A. —M6 airfoil (inverted).

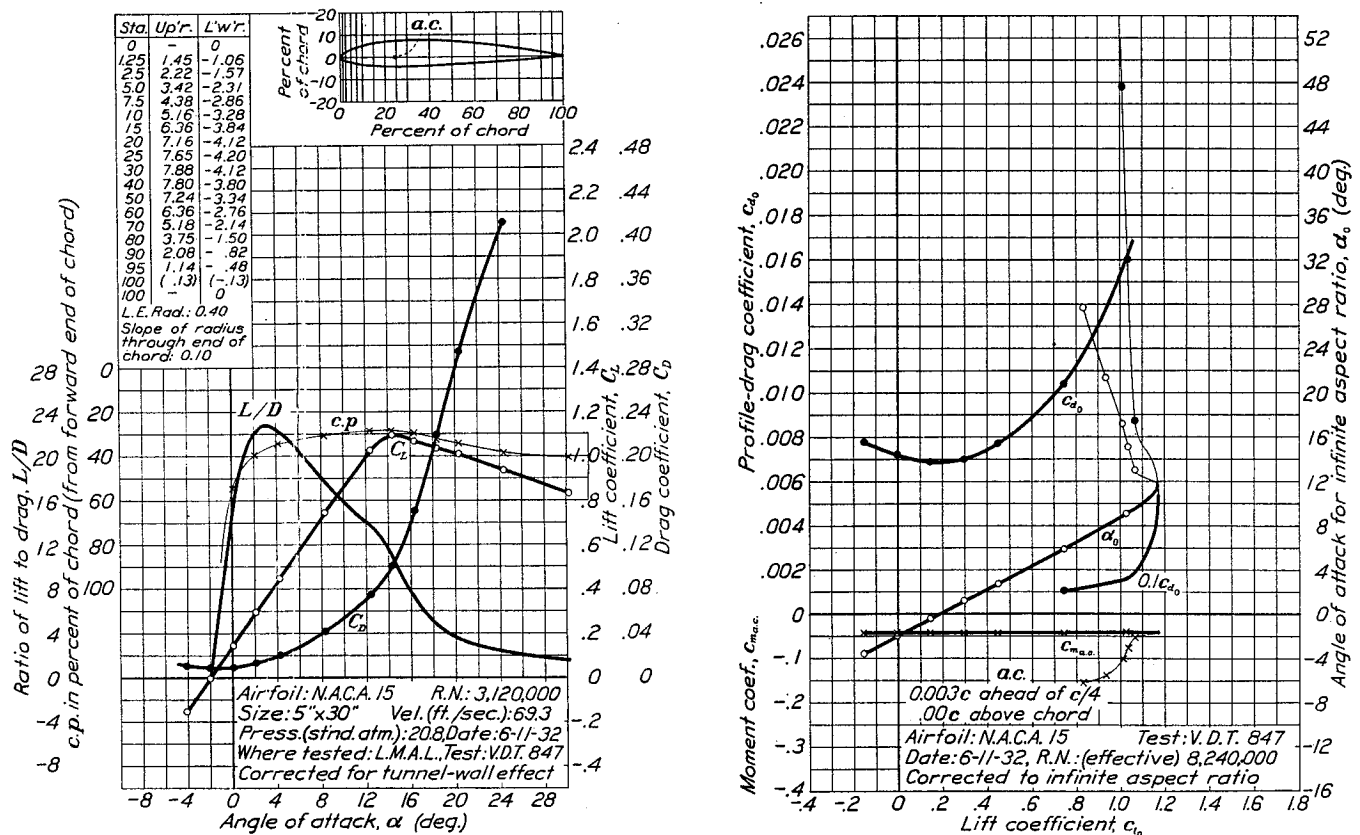


FIGURE 76.—N. A. C. A. 15 airfoil.

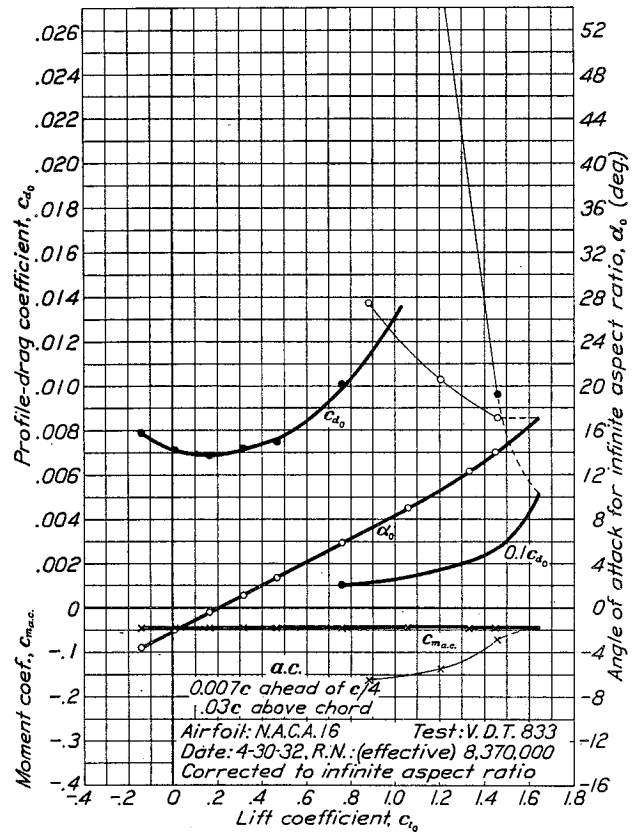
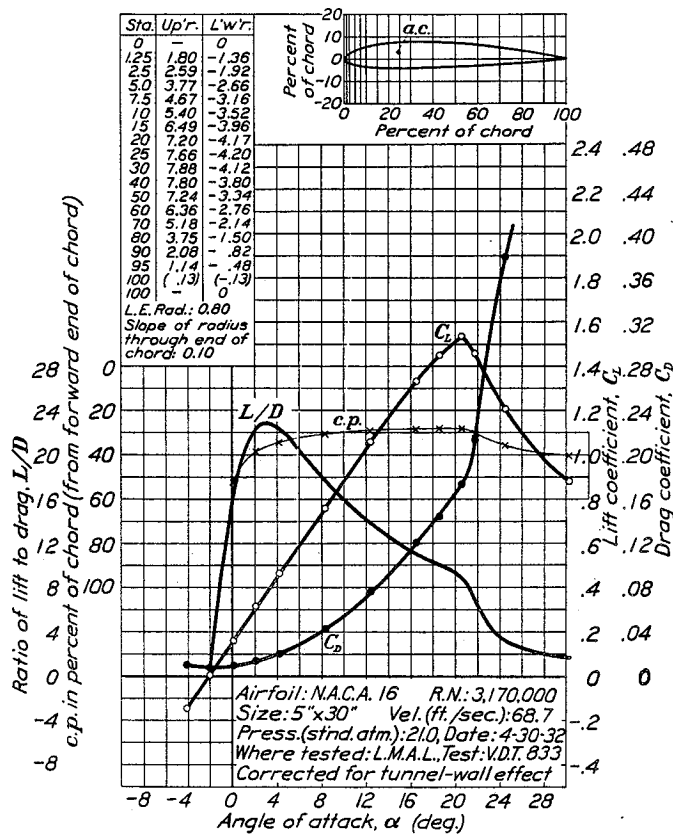


FIGURE 77.—N. A. C. A. 16 airfoil.

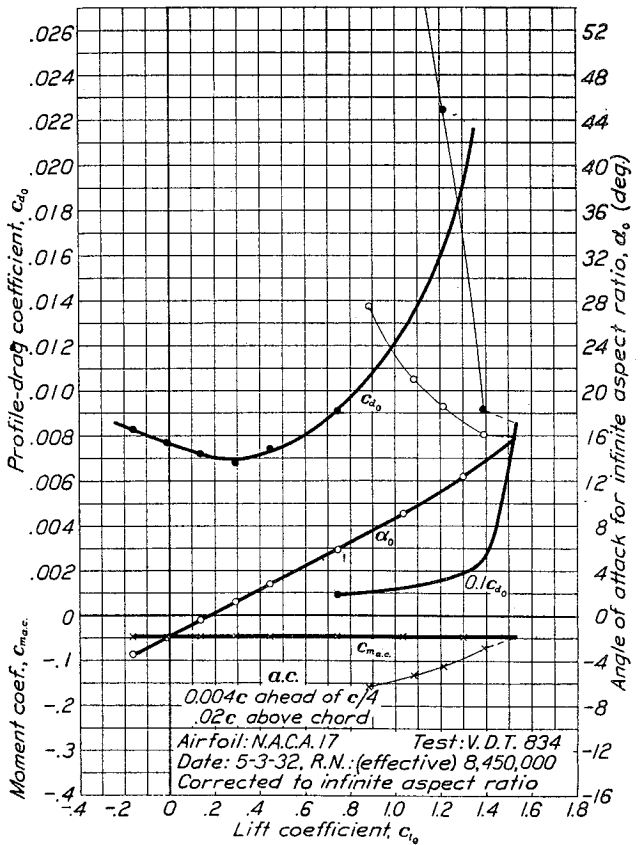
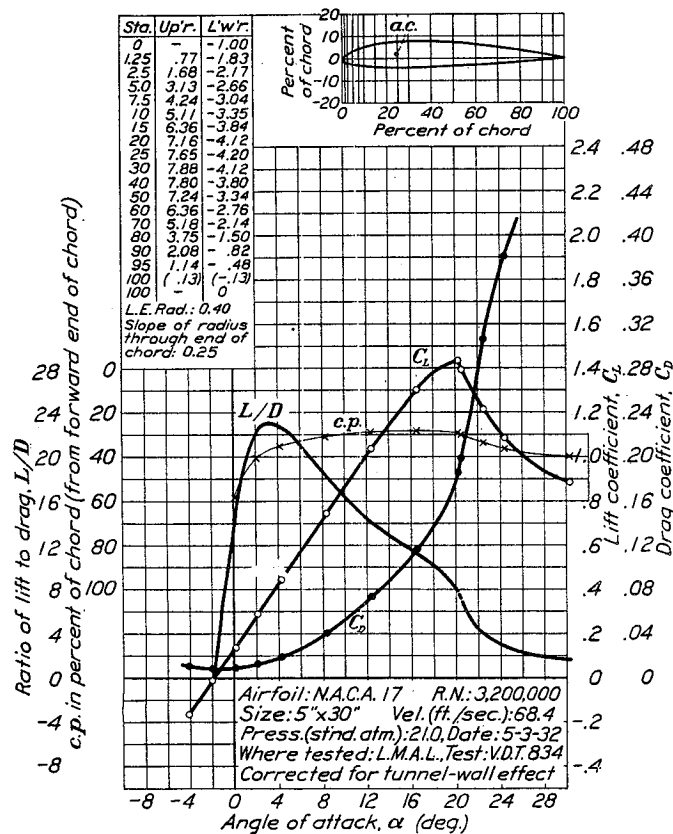


FIGURE 78.—N. A. C. A. 17 airfoil.

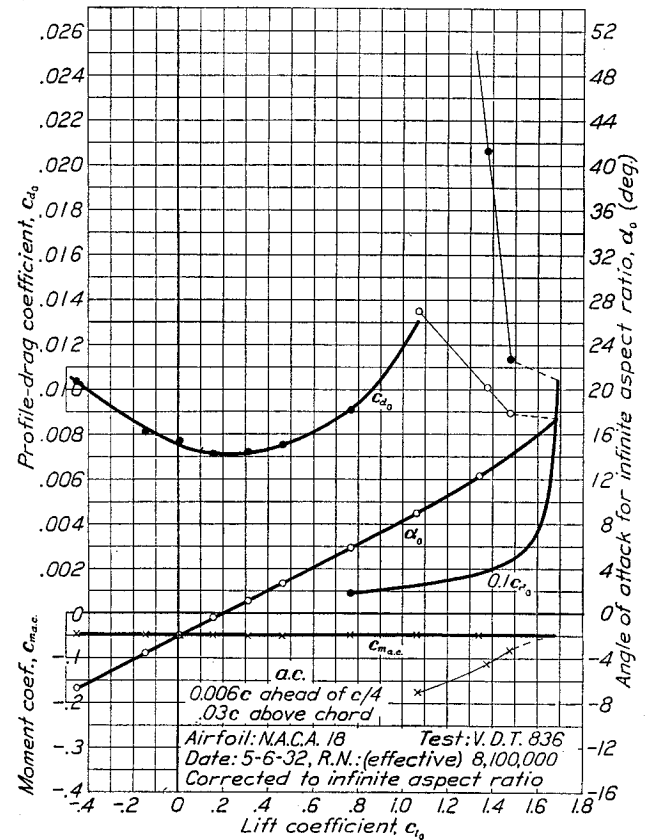
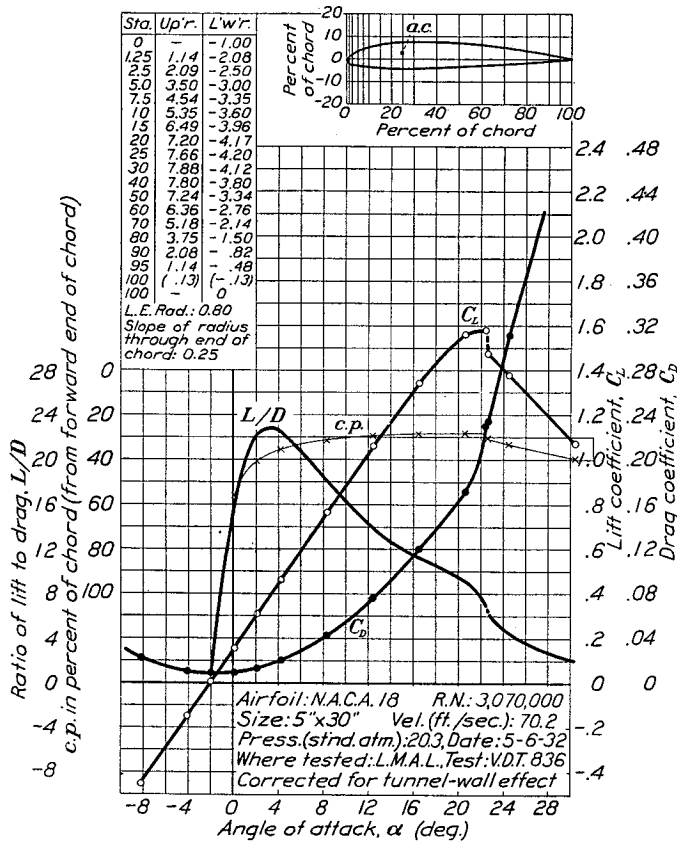


FIGURE 79.—N. A. C. A. 18 airfoil.

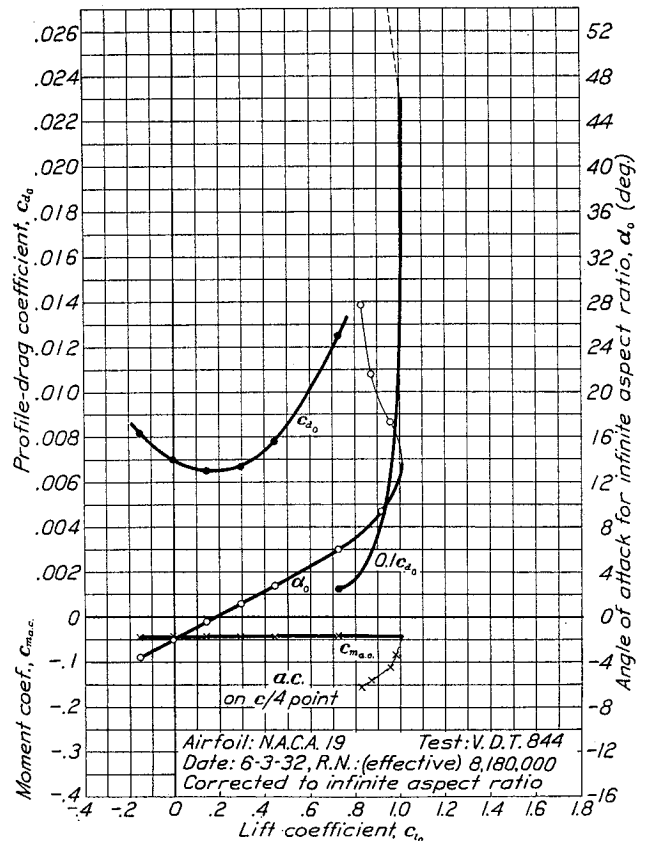
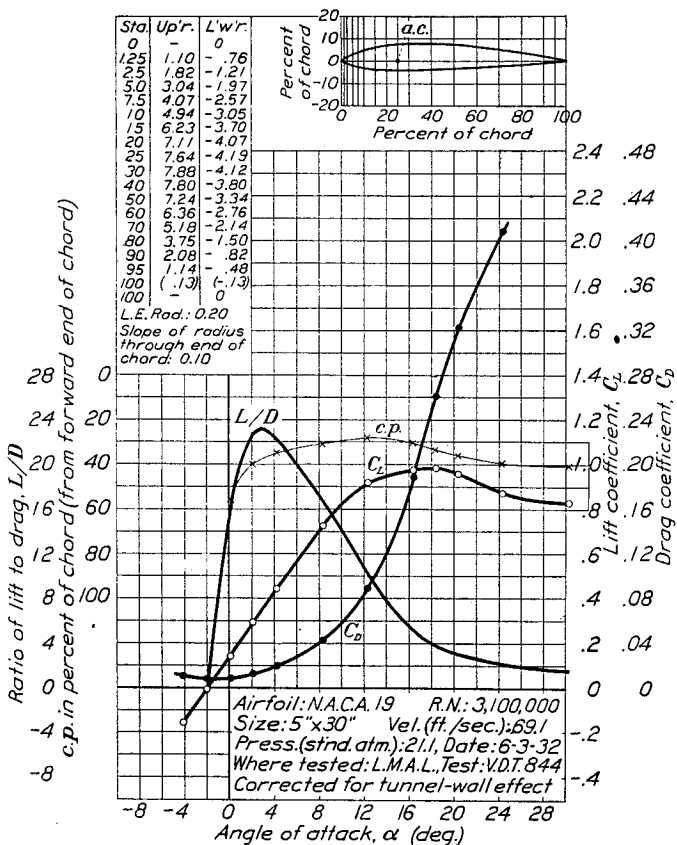


FIGURE 80.—N. A. C. A. 19 airfoil.

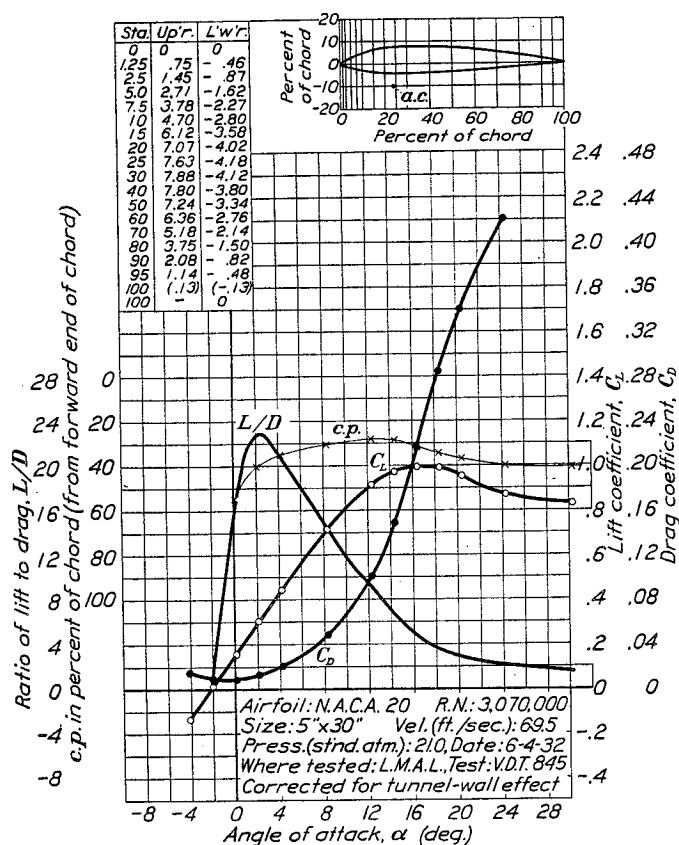


FIGURE 81.—N. A. C. A. 20 airfoil.

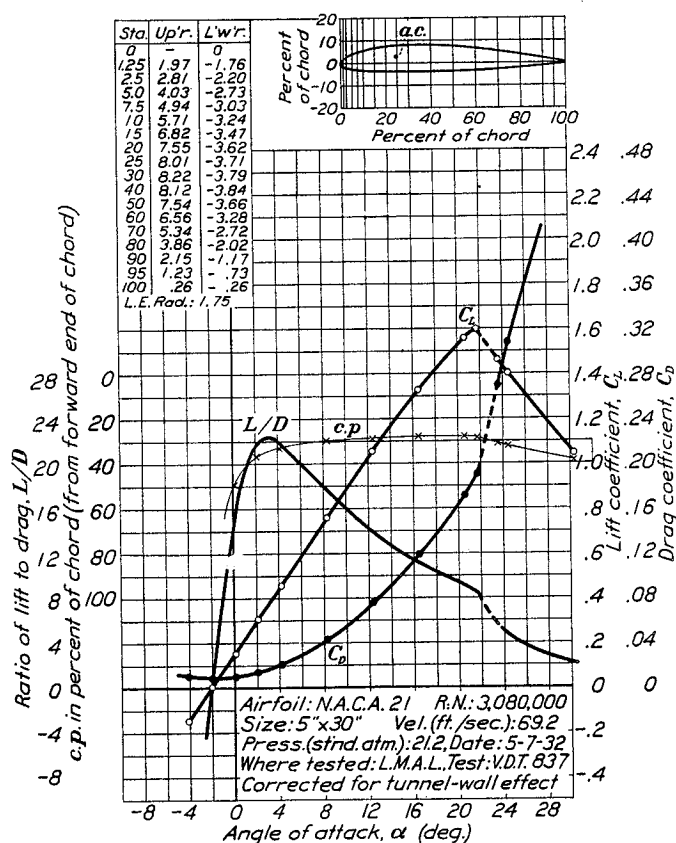
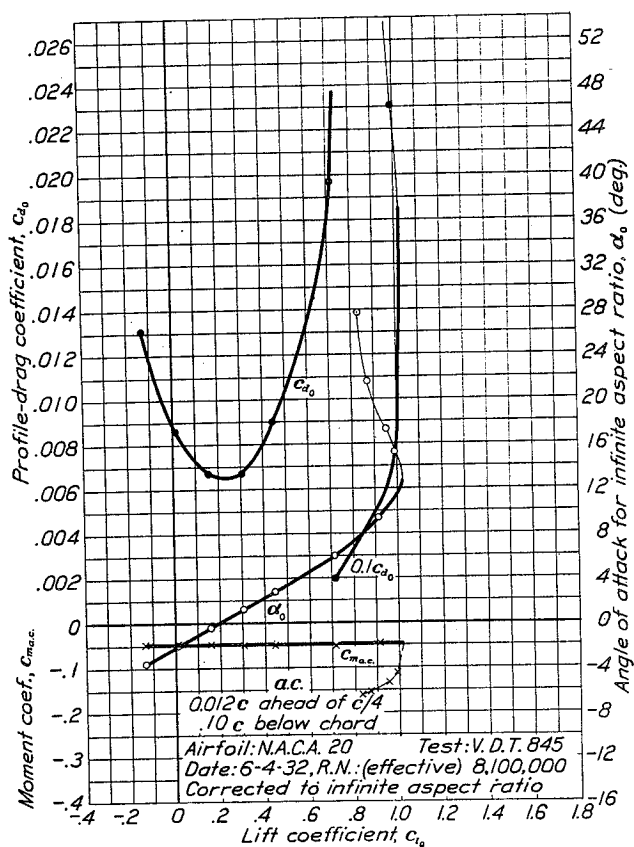
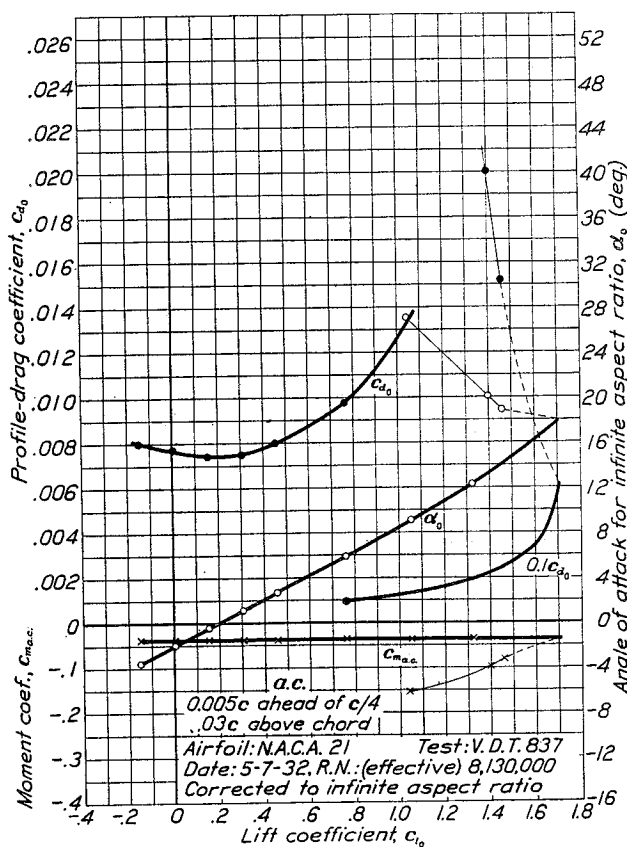


FIGURE 82.—N. A. C. A. 21 airfoil.



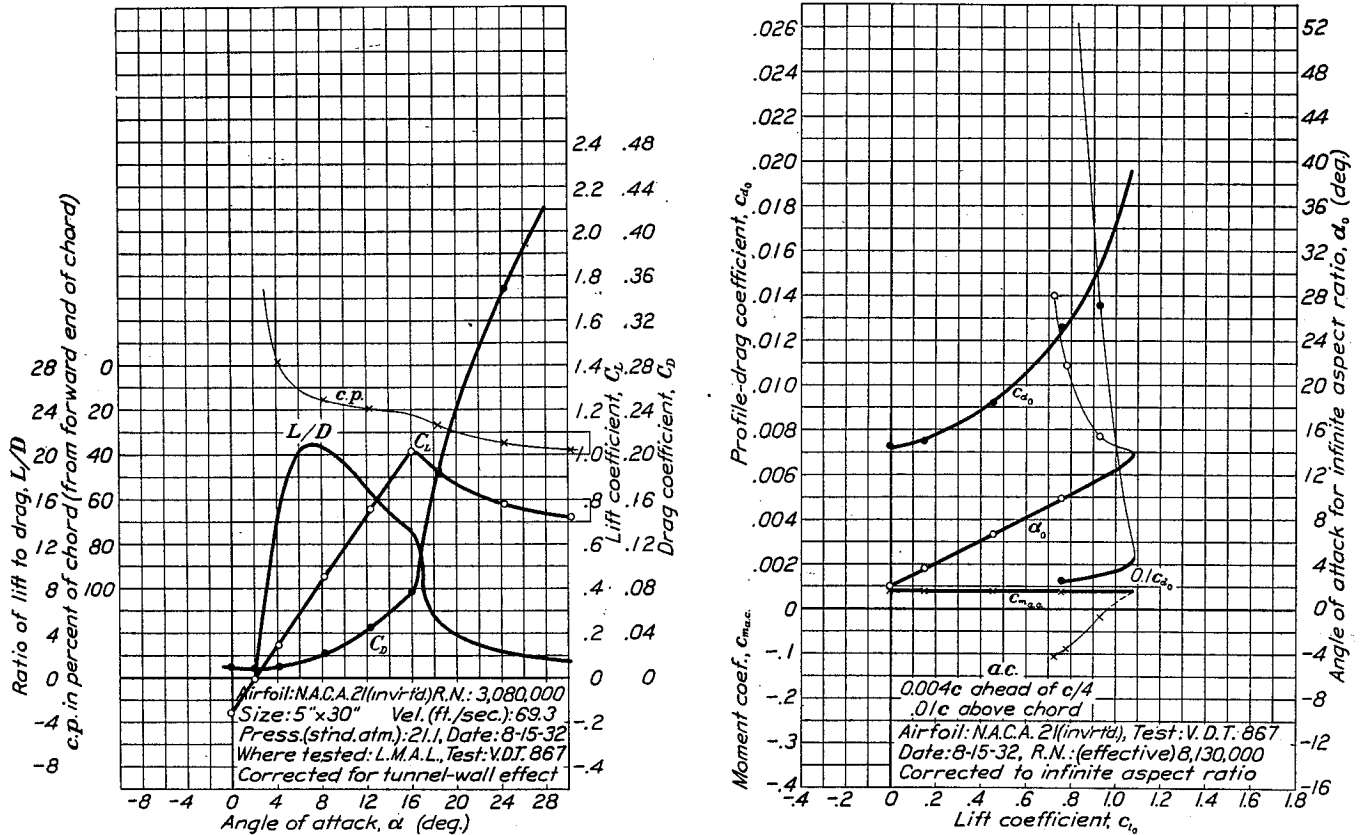


FIGURE 83.—N. A. C. A. 21 airfoil (inverted).

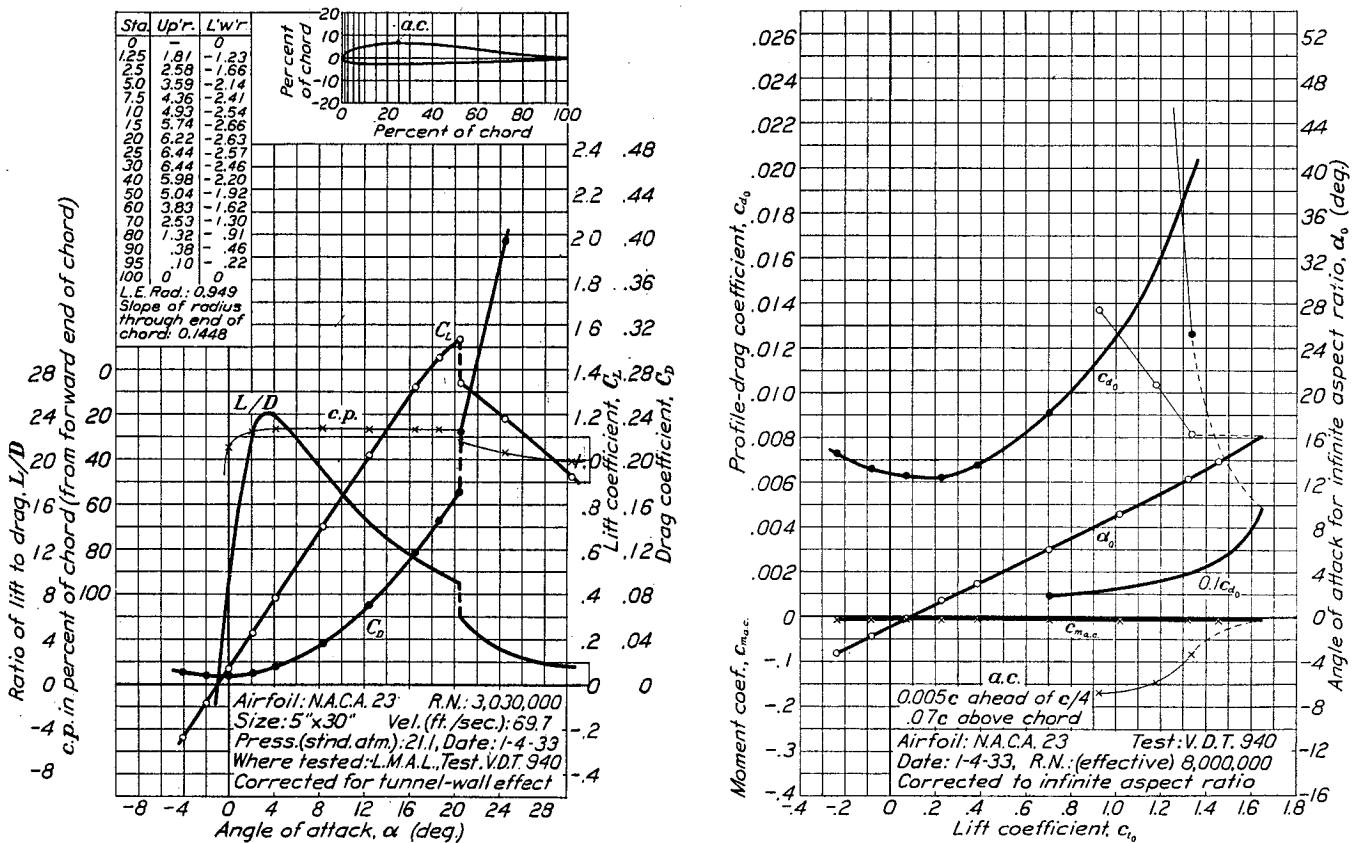


FIGURE 84.—N. A. C. A. 23 airfoil.

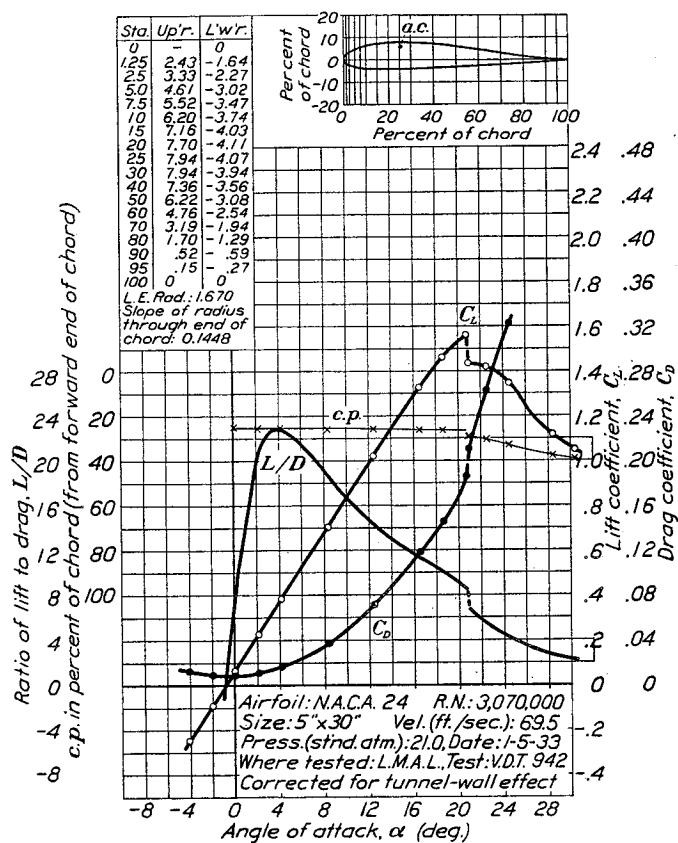


FIGURE 85.—N. A. C. A. 24 airfoil.

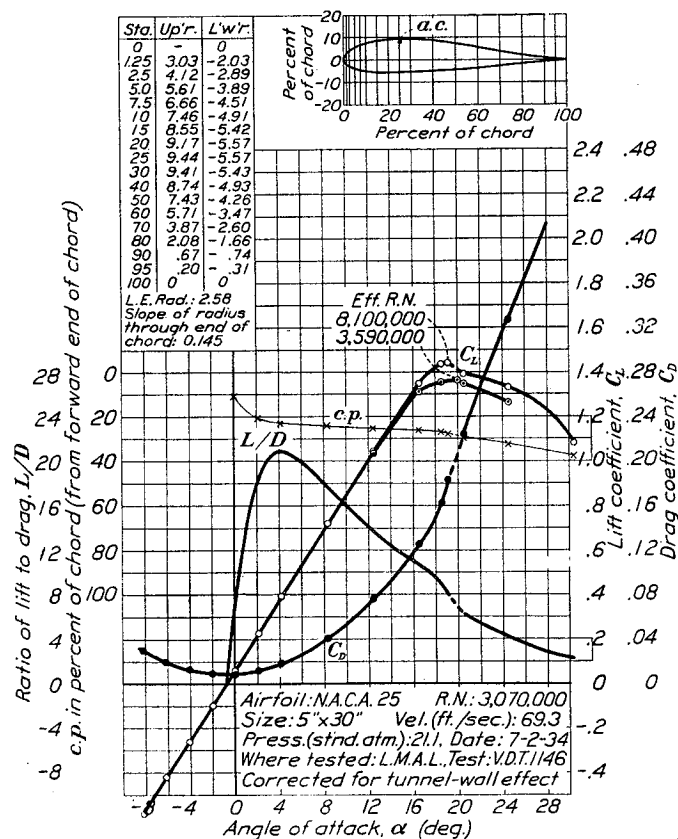
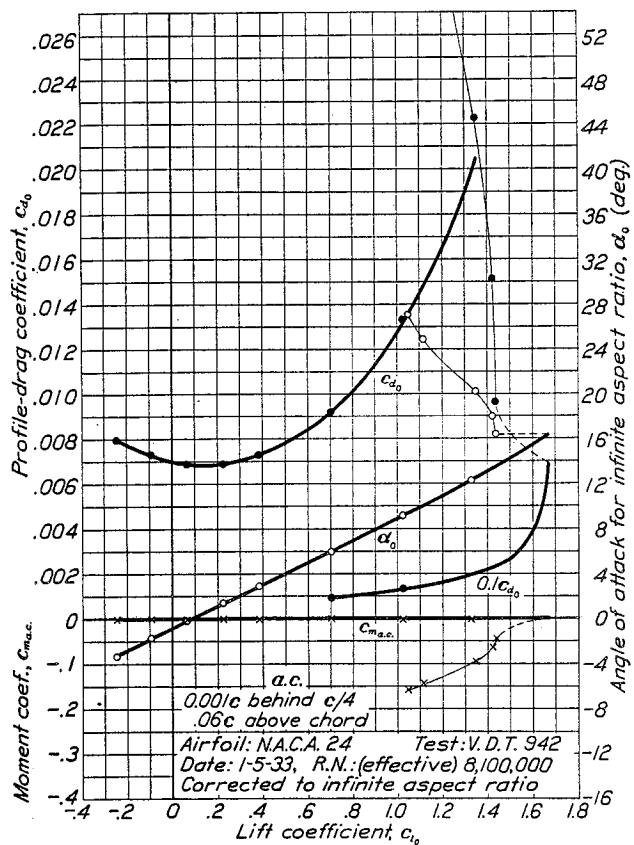
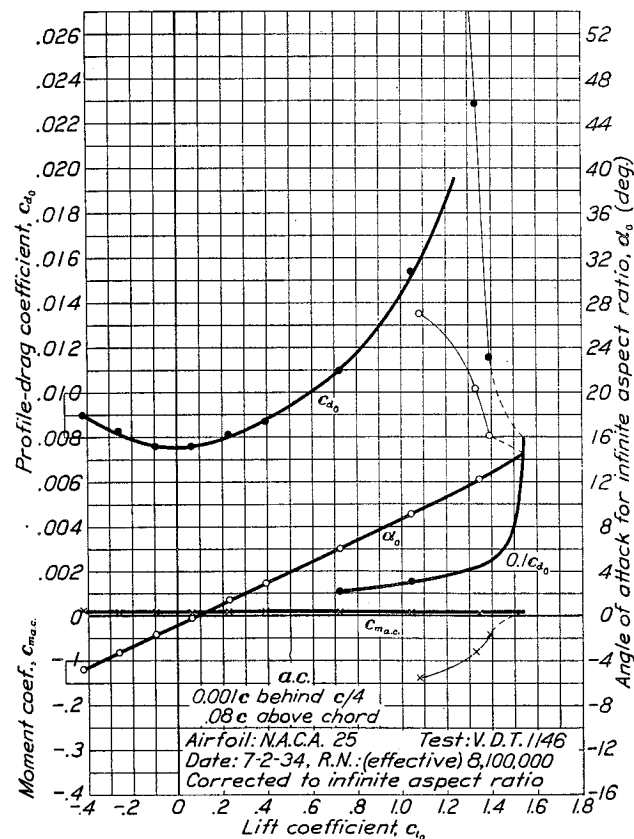


FIGURE 86.—N. A. C. A. 25 airfoil.



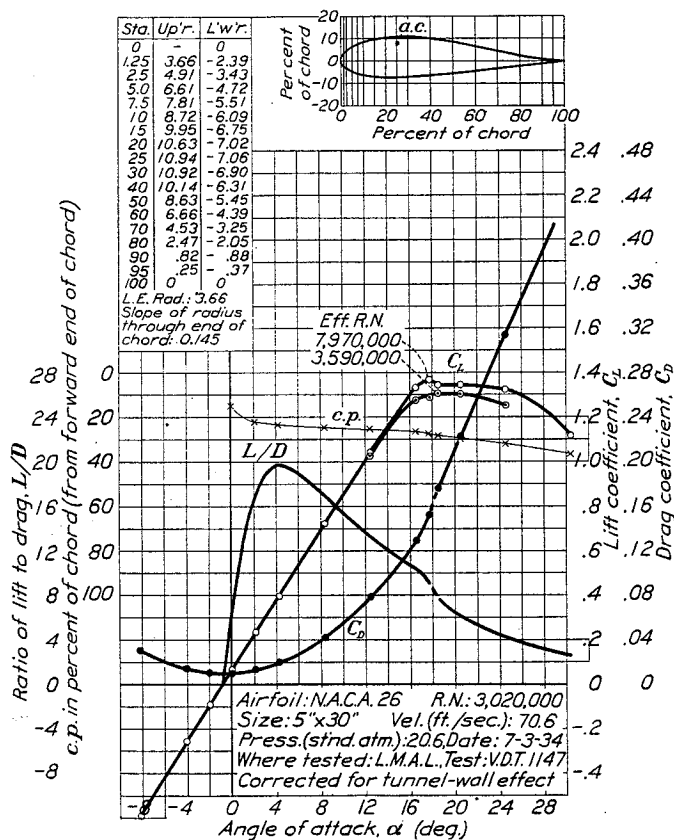


FIGURE 87.—N. A. C. A. 26 airfoil.

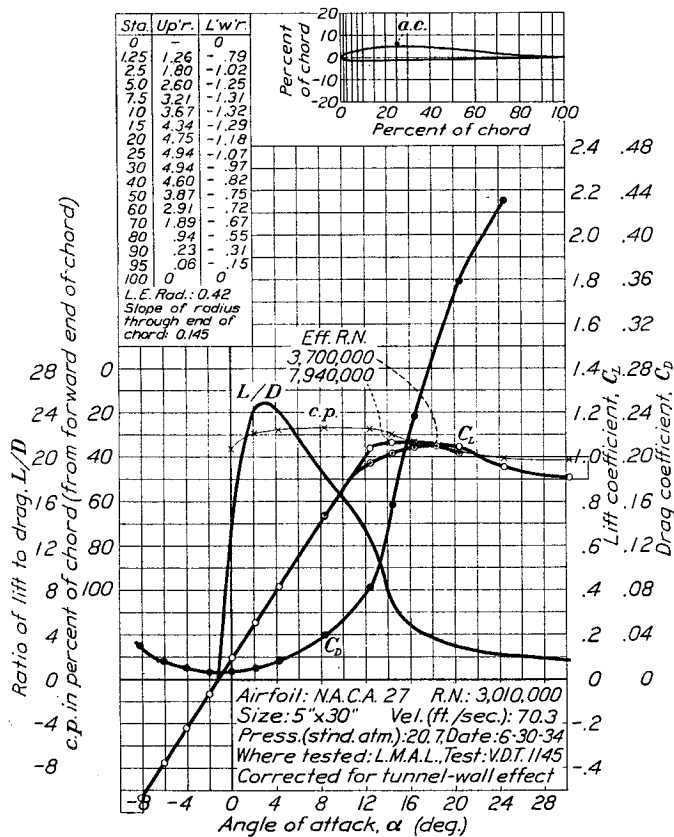
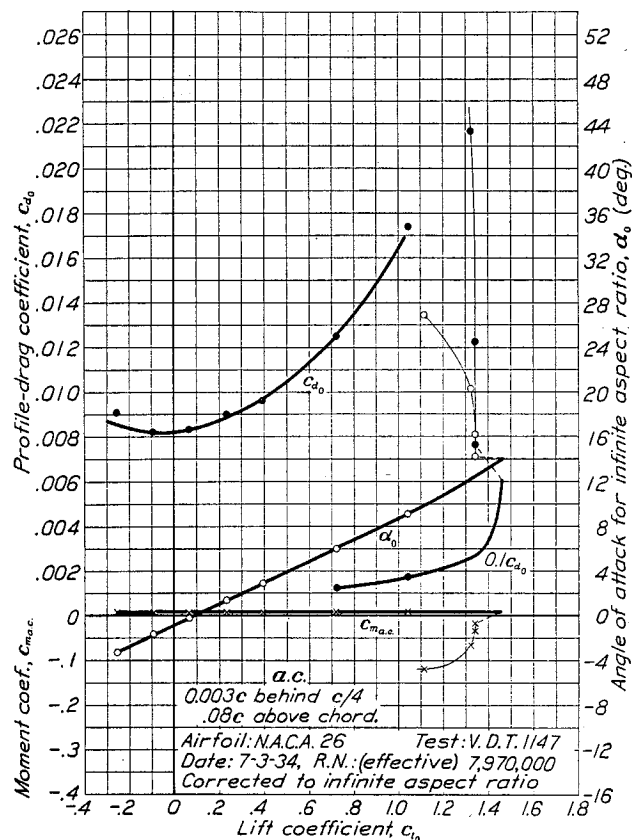


FIGURE 88.—N. A. C. A. 27 airfoil.

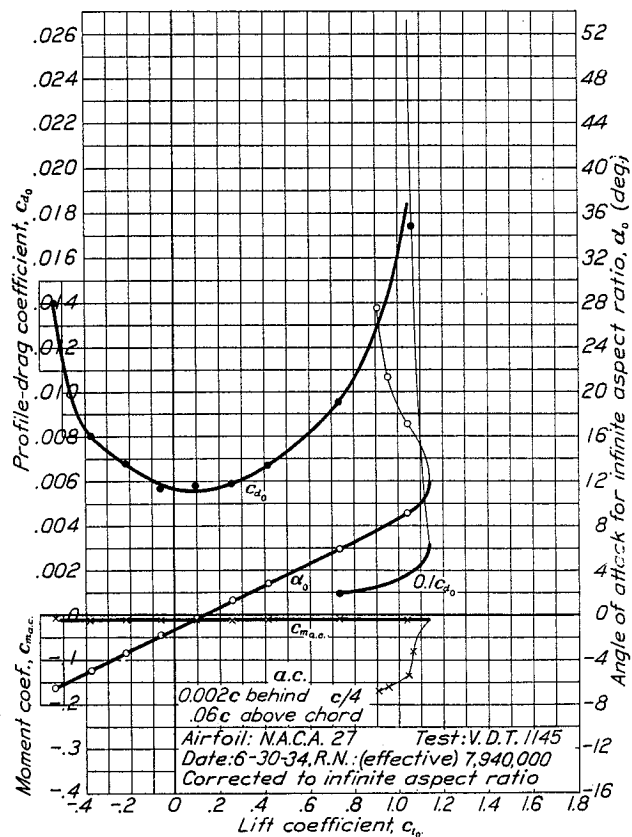


TABLE I.—CHARACTERISTICS OF RELATED N. A. C. A. AIRFOILS REPORTED IN REFERENCE 1

Airfoil	Classification			Fundamental section characteristics						Derived and additional characteristics that may be used for structural design				
	Chord	PD	SE	C_{Lmax}	Effective Reynolds Number (millions)	$\alpha_{1/2}$ (deg.)	$\alpha_{1/2}$ (deg.)	$\alpha_{1/2}$ (deg.)	$\alpha_{1/2}$ (deg.)	$\alpha_{1/2}$ (deg.)	$\alpha_{1/2}$ (deg.)	$\alpha_{1/2}$ (deg.)	$\alpha_{1/2}$ (deg.)	$\alpha_{1/2}$ (deg.)
N. A. C. A.:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
0006.....	A A	A10	A	D	8.5	0.91	0	0.054	0	0.054	0	0.054	0	0
0009.....	A A	A10	B0	A	8.3	1.39	0	0.064	0	0.064	0	0.064	0	0
0012.....	A A	A10	C0	A	8.4	1.66	0	0.069	0	0.069	0	0.069	0	0
0015.....	A A	A10	D0	A	8.6	1.66	0	0.077	0	0.077	0	0.077	0	0
0018.....	A A	A10	E0	A	7.8	1.53	0	0.088	0	0.088	0	0.088	0	0
0021.....	A A	A10	E1	A	8.3	1.48	0	0.100	0	0.100	0	0.100	0	0
0025.....	A A	A10	E2	A	8.5	1.28	0	0.119	0	0.119	0	0.119	0	0
2212.....	A A	C12	C3	B	8.4	1.72	-1.8	0.072	-0.29	0.072	-0.29	0.072	-0.29	12
2306.....	A A	A10	A	D	8.1	1.11	-1.8	0.063	-0.36	0.063	-0.36	0.063	-0.36	2
2309.....	A A	B10	B2	A	7.8	1.62	-2.0	0.099	-0.37	0.099	-0.37	0.099	-0.37	2
2312.....	A A	C10	C2	B	8.2	1.72	-1.9	0.074	-0.39	0.074	-0.39	0.074	-0.39	2
2315.....	A A	D10	D2	B	8.0	1.65	-1.7	0.083	-0.34	0.083	-0.34	0.083	-0.34	2
2406.....	A A	A10	A	D	8.2	1.04	-1.7	0.099	-0.39	0.099	-0.39	0.099	-0.39	2
2409.....	A A	B10	B2	A	8.1	1.62	-2.0	0.087	-0.44	0.087	-0.44	0.087	-0.44	2
2412.....	A A	C10	C2	B	8.2	1.72	-1.7	0.098	-0.40	0.098	-0.40	0.098	-0.40	2
2415.....	A A	D10	D2	B	8.0	1.66	-1.7	0.082	-0.40	0.082	-0.40	0.082	-0.40	2
2418.....	A A	E10	E2	B	8.2	1.53	-1.9	0.093	-0.38	0.093	-0.38	0.093	-0.38	2
2421.....	A A	F10	E3	B	7.9	1.44	-1.7	0.06	-0.35	0.06	-0.35	0.06	-0.35	2
2506.....	A A	A10	A	D	8.1	1.06	-2.0	0.099	-0.48	0.099	-0.48	0.099	-0.48	2
2509.....	A A	B10	B2	A	8.0	1.48	-2.1	0.088	-0.51	0.088	-0.51	0.088	-0.51	2
2512.....	A A	C10	C2	B	8.1	1.73	-2.1	0.098	-0.54	0.098	-0.54	0.098	-0.54	2
2515.....	A A	D10	D2	B	8.1	1.64	-2.0	0.085	-0.50	0.085	-0.50	0.085	-0.50	2
2518.....	A A	E10	E2	B	8.1	1.38	-2.0	0.092	-0.47	0.092	-0.47	0.092	-0.47	2
2612.....	A A	C10	C1	B	8.4	1.48	-1.8	0.086	-0.44	0.086	-0.44	0.086	-0.44	2
2712.....	A A	C10	C0	B	8.0	1.80	-2.6	0.096	-0.75	0.096	-0.75	0.096	-0.75	2
3006.....	A A	A10	A	D	8.5	1.83	-3.9	0.098	-0.90	0.098	-0.90	0.098	-0.90	2
3009.....	A A	B10	B4	A	8.1	1.77	-4.0	0.088	-0.88	0.088	-0.88	0.088	-0.88	2
3012.....	A A	C10	C4	D	7.9	1.74	-4.0	0.088	-0.88	0.088	-0.88	0.088	-0.88	2
3015.....	A A	D10	D4	C	8.1	1.72	-4.0	0.097	-0.85	0.097	-0.85	0.097	-0.85	2
3018.....	A A	E10	E4	D	8.1	1.57	-3.7	0.089	-0.78	0.089	-0.78	0.089	-0.78	2
3021.....	A A	F10	E5	D	8.2	1.41	-3.4	0.089	-0.71	0.089	-0.71	0.089	-0.71	2
3025.....	A A	A10	A	D	8.0	1.18	-4.3	0.100	-1.10	0.100	-1.10	0.100	-1.10	2
3030.....	A A	B10	B3	A	8.2	1.67	-4.1	0.099	-1.06	0.099	-1.06	0.099	-1.06	2
3033.....	A A	C10	C3	B	8.4	1.81	-4.2	0.093	-1.01	0.093	-1.01	0.093	-1.01	2
3036.....	A A	D10	D3	B	8.0	1.73	-4.1	0.097	-1.07	0.097	-1.07	0.097	-1.07	2
3039.....	A A	E10	E3	D	8.2	1.65	-3.9	0.092	-0.93	0.092	-0.93	0.092	-0.93	2
3042.....	A A	F10	E4	D	8.2	1.50	-3.4	0.091	-0.82	0.091	-0.82	0.091	-0.82	2
3045.....	A A	C10	C2	B	8.3	1.88	-4.6	0.094	-1.24	0.094	-1.24	0.094	-1.24	2
3048.....	A A	D10	D6	B	8.1	1.53	-5.2	0.094	-1.15	0.094	-1.15	0.094	-1.15	2
3051.....	A A	E10	E7	D	8.2	1.41	-5.2	0.092	-1.09	0.092	-1.09	0.092	-1.09	2
3054.....	A A	A10	B0	D	8.1	1.53	-5.6	0.100	-1.29	0.100	-1.29	0.100	-1.29	2
3057.....	A A	B10	B6	D	8.0	1.80	-5.9	0.097	-1.33	0.097	-1.33	0.097	-1.33	2
3060.....	A A	C10	C6	D	8.2	1.82	-5.9	0.098	-1.33	0.098	-1.33	0.098	-1.33	2
3063.....	A A	D10	D6	D	8.0	1.70	-5.7	0.095	-1.25	0.095	-1.25	0.095	-1.25	2
3066.....	A A	E10	E6	D	8.1	1.62	-5.7	0.095	-1.18	0.095	-1.18	0.095	-1.18	2
3069.....	A A	F10	E7	D	8.0	1.51	-5.2	0.092	-1.10	0.092	-1.10	0.092	-1.10	2
3072.....	A A	A10	A	D	8.3	1.35	-7.6	0.097	-1.59	0.097	-1.59	0.097	-1.59	2
3075.....	A A	B10	B4	D	8.2	1.83	-6.3	0.099	-1.58	0.099	-1.58	0.099	-1.58	2
3078.....	A A	C10	C5	D	8.4	1.87	-6.2	0.100	-1.55	0.100	-1.55	0.100	-1.55	2
3081.....	A A	D10	D6	D	8.1	1.79	-6.0	0.095	-1.47	0.095	-1.47	0.095	-1.47	2
3084.....	A A	E10	E6	D	8.1	1.72	-5.7	0.091	-1.40	0.091	-1.40	0.091	-1.40	2
3087.....	A A	F10	E7	D	8.1	1.60	-5.3	0.090	-1.39	0.090	-1.39	0.090	-1.39	2
3090.....	A A	A10	C4	D	8.5	1.95	-6.6	0.095	-1.85	0.095	-1.85	0.095	-1.85	2
3093.....	A A	C10	C2	A	8.1	2.05	-7.3	0.096	-1.99	0.096	-1.99	0.096	-1.99	2
3096.....	A A	A10	A	D	8.4	0.91	0	0.086	0	0.086	0	0.086	0	0
3099.....	A A	B10	B0	D	8.4	1.13	0	0.100	0	0.100	0	0.100	0	0
3102.....	A A	C10	C0	D	8.2	1.10	0	0.095	0	0.095	0	0.095	0	0
3105.....	A A	D10	D0	D	8.3	1.38	0	0.097	0	0.097	0	0.097	0	0
3108.....	A A	E10	E2	A	8.3	1.28	0	0.083	0	0.083	0	0.083	0	0
3111.....	A A	F10	E2	A	8.3	1.64	-1.5	0.093	-0.20	0.093	-0.20	0.093	-0.20	0
3114.....	A A	C11	C3	B	8.4	1.61	-1.6	0.098	-0.05	0.098	-0.05	0.098	-0.05	0
3117.....	A A	D11	D3	B	8.4	1.64	-1.6	0.098	-0.05	0.098	-0.05	0.098	-0.05	0
3120.....	A A	E11	E3	B	8.5	1.64	-1.6	0.098	-0.05	0.098	-0.05	0.098	-0.05	0
3123.....	A A	F11	F3	B	8.5	1.64	-1.6	0.098	-0.05	0.098	-0.05	0.098	-0.05	0
3126.....	A A	C12	C0	A	8.5	2.19	-11.7	0.095	-1.96	0.095	-1.96	0.095	-1.96	0

* Type of chord. See reference 10.

* Type of pressure distribution. See reference 10.

* Type of scale effect on maximum lift. A signifies practically no scale effect.

* For other designations see reference 9, fig. 44.

* See footnote 4, table II.

* Turbulence factor is 2 ft.

* These data have been corrected for tip effect.

* Based on straight portion of lift curve extended.

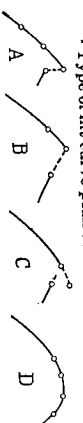
TABLE II.—CHARACTERISTICS OF MISCELLANEOUS AIRFOILS

[An inverted airfoil is considered as another distinct section]

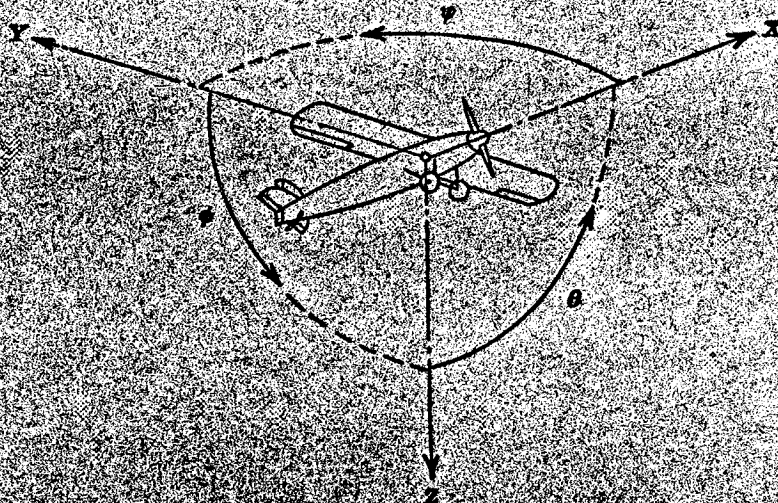
Airfoil	Fig- ure No.	N. A. C. A. refer- ence, R=, N=, note	Classification				Effec- tive Revol- utions (mil- lions)	Fundamental section characteristics										Derived and additional characteristics that may be used for structural design									
			Chord	PD	SE	$C_{L_{max}}$		α_{t_0} (deg.)	α_0 (per deg.)	$C_{l_{opt}}$	$C_{D_{0_{min}}}$	$C_{m_{a-c}}$	a. c. (percent c from c/4)		$\frac{C_{L_{max}}}{C_{D_{0_{min}}}}$	c. p. at $C_{L_{max}}$ (per- cent c)	Wing charac- teristics $A=6$, round tips			Thickness at		Cam- ber (per- cent c)					
													Ahead	Above			m_0 (per radian)	$C_{D_{min}}$	0.15c (per- cent c)	0.65c (per- cent c)	Maxi- mum (per- cent c)						
Boeing 103	1	N 412	(1) B	(2) C10	(3) C4	(4) B	(5) 8.0	(6) 1.76	(6) -4.8	(6) 0.097	(6) 0.15	(6) 0.0088	-0.065	7	200	30	4.24	0.0089	11.21	9.14	12.08	4.2					
Boeing 103 (inv.)	2	N 412	(1) B	(2) B10	(3) C3	(4) B	(5) 8.6	(6) 1.66	(6) -3.8	(6) 0.098	(6) 0.17	(6) 0.0075	-0.069	-2	232	16	4.28	0.0077	9.18	7.52	10.38	3.2					
Boeing 103A	3	N 412	(1) B	(2) C10	(3) B4	(4) D	(5) 8.4	(6) 1.85	(6) -4.4	(6) 0.098	(6) 0.14	(6) 0.0081	-0.058	0	202	20	4.34	0.0082	11.26	9.26	13.06	3.5					
Boeing 103A (inv.)	4	N 412	(1) C	(2) C10	(3) B4	(4) B	(5) 8.1	(6) 1.88	(6) -4.4	(6) 0.093	(6) 0.14	(6) 0.0081	-0.057	2	202	20	4.11	0.0082	11.26	9.26	13.06	3.5					
Boeing 106	5	N 412	(1) C	(2) C10	(3) B4	(4) B	(5) 8.1	(6) 1.88	(6) -4.4	(6) 0.093	(6) 0.14	(6) 0.0081	-0.057	2	202	17	4.11	0.0082	11.26	9.26	13.06	3.5					
Boeing 106R	6	N 412	(1) C	(2) C10	(3) B4	(4) B	(5) 8.1	(6) 1.88	(6) -4.4	(6) 0.093	(6) 0.14	(6) 0.0081	-0.057	2	202	17	4.11	0.0082	11.26	9.26	13.06	3.5					
Boeing 106R	7	N 388	(1) C	(2) C11	(3) B3	(4) D	(5) 8.3	(6) 1.48	(6) -1.1	(6) 0.095	(6) 0.05	(6) 0.0077	-0.001	3	192	27	4.18	0.0077	11.26	9.29	13.06	2.0					
Boeing 111	8	N 412	(1) A	(2) C10	(3) D3	(4) A	(5) 7.8	(6) 1.68	(6) -2.1	(6) 0.096	(6) 0.17	(6) 0.0071	-0.033	6	137	28	4.20	0.0073	9.92	8.14	11.50	3.0					
Boeing 111 (inv.)	9	N 412	(1) A	(2) C10	(3) D3	(4) A	(5) 8.1	(6) 1.89	(6) -2.0	(6) 0.096	(6) 0.20	(6) 0.0071	-0.033	2	238	21	4.20	0.0074	9.92	8.12	11.50	2.8					
Boeing 112	10	N 412	(1) A	(2) C10	(3) D2	(4) C	(5) 8.2	(6) 1.69	(6) -2.0	(6) 0.096	(6) 0.20	(6) 0.0071	-0.023	7	238	28	4.20	0.0074	9.92	8.12	11.50	2.8					
Boeing 112 (inv.)	11	N 412	(1) A	(2) C10	(3) D2	(4) C	(5) 8.3	(6) 1.70	(6) -2.0	(6) 0.096	(6) 0.20	(6) 0.0071	-0.023	7	238	34	4.20	0.0074	9.92	8.12	11.50	2.8					
Sikorsky GS-M	12		(1) B	(2) D10	(3) D6	(4) D	(5) 8.1	(6) 1.69	(6) -7.9	(6) 0.099	(6) 0.30	(6) 0.0096	-0.105	6	176	34	4.31	0.0101	15.29	9.11	16.05	5.5					
Sikorsky GS-M (inv.)	13		(1) B	(2) D10	(3) D4	(4) D	(5) 8.3	(6) 1.89	(6) -6.8	(6) 0.097	(6) 0.25	(6) 0.0082	-0.094	4	217	32	4.24	0.0086	12.84	8.31	13.98	4.5					
Sikorsky GS-I	14		(1) B	(2) D10	(3) D4	(4) D	(5) 8.5	(6) 1.16	(6) -10.2	(6) 0.100	(6) 0.40	(6) 0.0127	-0.177	0	135	36	4.34	0.0137	15.96	8.20	19.80	8.0					
Sikorsky GS-I (inv.)	15		(1) B	(2) F10	(3) E8	(4) D	(5) 8.0	(6) 1.72	(6) -10.2	(6) 0.098	(6) 0.20	(6) 0.0071	-0.177	0	135	36	4.34	0.0137	15.96	8.20	19.80	8.0					
S. T. A. 27A	16		(1) A	(2) C11	(3) C1	(4) C	(5) 8.0	(6) 1.58	(6) -8	(6) 0.098	(6) 0.20	(6) 0.0071	-0.066	4	222	27	4.28	0.0072	10.88	8.55	12.64	1.8					
R. A. F. 34	17		(1) A	(2) C11	(3) C1	(4) C	(5) 8.0	(6) 1.58	(6) -8	(6) 0.098	(6) 0.20	(6) 0.0071	-0.066	4	222	27	4.28	0.0072	10.88	8.55	12.64	1.8					
U. S. A. 27	18	N 412	(1) B	(2) C10	(3) C6	(4) B	(5) 8.1	(6) 1.71	(6) -4.7	(6) 0.094	(6) 0.30	(6) 0.0086	-0.078	5	199	30	4.14	0.0088	10.40	8.70	11.12	5.6					
U. S. A. 27 (inv.)	19	N 412	(1) B	(2) C10	(3) C6	(4) D	(5) 8.1	(6) 1.52	(6) -8.0	(6) 0.094	(6) 0.38	(6) 0.0116	-0.080	0	131	29	4.14	0.0121	16.60	11.90	18.18	7.3					
U. S. A. 35-A	20	N 412	(1) B	(2) E10	(3) E6	(4) B	(5) 8.4	(6) 1.52	(6) -5.2	(6) 0.095	(6) 0.35	(6) 0.0083	-0.076	5	218	34	4.18	0.0121	16.60	11.90	18.18	7.3					
U. S. A. 35-B	21	N 412	(1) B	(2) C10	(3) C5	(4) D	(5) 8.3	(6) 1.81	(6) -5.2	(6) 0.099	(6) 0.35	(6) 0.0083	-0.076	5	218	30	4.31	0.0087	10.56	7.54	11.61	4.6					
U. S. A. 35-B (inv.)	22	N 412	(1) B	(2) C10	(3) C5	(4) D	(5) 8.3	(6) 1.81	(6) -5.2	(6) 0.099	(6) 0.35	(6) 0.0083	-0.076	5	218	24	4.41	0.0087	10.56	7.54	11.61	4.6					
C-62	23	N 412	(1) A	(2) D10	(3) A	(4) D	(5) 8.4	(6) 1.06	(6) -1.8	(6) 0.095	(6) 0.15	(6) 0.0065	-0.038	4	163	34	4.18	0.0067	7.09	5.72	8.04	1.9					
C-72	24	N 412	(1) B	(2) C10	(3) C4	(4) D	(5) 8.0	(6) 1.74	(6) -5.6	(6) 0.095	(6) 0.23	(6) 0.0083	-0.084	6	210	30	4.18	0.0087	10.53	7.39	11.73	4.0					
C-72 (inv.)	25	N 412	(1) B	(2) C10	(3) C4	(4) D	(5) 8.1	(6) 1.83	(6) -5.6	(6) 0.096	(6) 0.23	(6) 0.0083	-0.085	0	201	31	4.24	0.0090	11.17	7.88	12.37	4.0					
C-80	26	N 412	(1) A	(2) B10	(3) A	(4) D	(5) 8.2	(6) 1.24	(6) -1.0	(6) 0.098	(6) 0.05	(6) 0.0064	-0.015	2	194	29	4.20	0.0087	10.56	7.54	11.61	4.6					
C-80 (inv.)	27	N 412	(1) A	(2) B10	(3) A	(4) D	(5) 8.1	(6) 1.81	(6) -1.0	(6) 0.098	(6) 0.05	(6) 0.0064	-0.015	2	194	29	4.28	0.0064	7.91	5.77	8.58	1.3					
N-22	28	N 412	(1) B	(2) C10	(3) C4	(4) D	(5) 8.1	(6) 1.72	(6) -5.4	(6) 0.096	(6) 0.17	(6) 0.0087	-0.075	4	198	30	4.20	0.0089	11.25	8.36	12.37	4.3					
N-22 (inv.)	29	N 412	(1) B	(2) C10	(3) C4	(4) D	(5) 8.1	(6) 1.84	(6) -5.4	(6) 0.098	(6) 0.30	(6) 0.0086	-0.082	0	201	31	4.24	0.0090	11.17	7.88	12.37	4.0					
N-60	30	N 388	(1) B	(2) C10	(3) C3	(4) D	(5) 8.1	(6) 1.73	(6) -5.5	(6) 0.097	(6) 0.30	(6) 0.0086	-0.078	0	201	31	4.24	0.0090	11.17	7.88	12.37	4.0					
N-60 R	31	N 388	(1) B	(2) C10	(3) C4	(4) D	(5) 8.3	(6) 1.50	(6) -1.5	(6) 0.098	(6) 0.09	(6) 0.0077	-0.001	6	195	27	4.26	0.0078	11.17	7.88	12.37	2.8					
N-68	32	N 388	(1) A	(2) B10	(3) A	(4) D	(5) 8.1	(6) 1.96	(6) 0	(6) 0.097	(6) 0	(6) 0.0060	0	5	160	25	4.24	0.0061	6.90	5.76	8.00	0					
N-69	33		(1) A	(2) B10	(3) A	(4) D	(5) 8.1	(6) 1.00	(6) 0	(6) 0.093	(6) 0	(6) 0.0066	0	8	152	25	4.11	0.0066	8.46	8.22	10.94	0					
N-71	34		(1) C	(2) C10	(3) C2	(4) D	(5) 8.3	(6) 1.67	(6) -2.0	(6) 0.099	(6) 0.18	(6) 0.0066	-0.029	7	253	28	4.31	0.0068	9.99	7.52	11.54	2.0					
N-71 (inv.)	35		(1) C	(2) C10	(3) C2	(4) D	(5) 8.3	(6) 1.24	(6) -2.2	(6) 0.097	(6) 0.15	(6) 0.0075	-0.045	9	224	23	4.31	0.0077	9.99	8.69	11.50	2.0					
N-75	36		(1) C	(2) C10	(3) C2	(4) D	(5) 7.9	(6) 1.68	(6) -2.2	(6) 0.097	(6) 0.15	(6) 0.0075	-0.045	9	224	23	4.31	0.0077	9.99	8.69	11.50	2.0					
N-75 (inv.)	37		(1) C	(2) C10	(3) C2	(4) D	(5) 8.2	(6) 1.09	(6) -2.2	(6) 0.096	(6) 0.15	(6) 0.0075	-0.046	7	224	20	4.20	0.0077	9.99	8.69	11.50	2.0					
N-76	38		(1) C	(2) C10	(3) C3	(4) D	(5) 8.2	(6) 1.63	(6) -2.1	(6) 0.096	(6) 0.19	(6) 0.0078	-0.032	7	209	28	4.20	0.0081	10.00	8.69	11.50	2.7					
N-76 (inv.)	39		(1) C	(2) C10	(3) C2	(4) D	(5) 8.0	(6) 1.99	(6) -2.2	(6) 0.095	(6) 0.16	(6) 0.0069	-0.032	5	252	21	4.18	0.0071	10.02	7.59	11.54	2.0					
N-80	40		(1) C	(2) C10	(3) C2	(4) D	(5) 8.4	(6) 1.74	(6) -2.2	(6) 0.098	(6) 0.16	(6) 0.0069	-0.032	5	252	29	4.28	0.0071	10.02	7.59	11.54	2.0					
N-80 (inv.)	41		(1) C	(2) C10	(3) C2	(4) D	(5) 8.5	(6) 1.17	(6) -2.2	(6) 0.100	(6) 0.100	(6) 0.0072	-0.043	0	0	22	4.34	0.0073	10.60	7.18	11.54	2.0					
N-81	42		(1) C	(2) C10	(3) C2	(4) A	(5) 8.5	(6) 1.79	(6) -2.2	(6) 0.100	(6) 0.14	(6) 0.0072	-0.041	2	249	29	4.34	0.0073	10.60	7.18	11.54	2.0					
N-81 (inv.)	43		(1) C	(2) C10	(3) C2	(4) A	(5) 8.5	(6) 1.26	(6) -2.2	(6) 0.101	(6) 0.14	(6) 0.0072	-0.041	2	249	22	4.37	0.0073	10.60	7.18	11.54	2.0					
G81t 387	44	N 428	(1) B	(2) D10	(3) D6	(4) D	(5) 8.4	(6) 1.70	(6) -6.6	(6) 0.097	(6) 0.30	(6) 0.0091	-0.032	7	187	32	4.24	0.0097	13.40	9.69	14.85	5.9					
G81t 398	45	N 412	(1) B	(2) D10	(3) D5	(4) D	(5) 8.1	(6) 1.68	(6) -6.0	(6) 0.094	(6) 0.15	(6) 0.0091	-0.031	4	185	31	4.14	0.0094	12.50	9.27	13.75	4.9					
G81t 3																											

CHARACTERISTICS OF AIRFOILS TESTED IN THE VARIABLE-DENSITY TUNNEL

Götl. 420	51	B	E10	C0	E4	D	8.2	1.51	-8.3	.095	.18	.0104	-.084	-4	7	145	34	4.18	.0107	16.50	11.84	18.75	4.5
Götl. 429-A	52	A	C10	C0	C0	A	8.1	1.61	0	.100	0	.0068	0	-1	4	244	26	4.34	.0066	10.35	6.60	11.28	0
Götl. 429-B	53	A	C10	C0	C0	A	8.0	1.65	-4.4	.102	.22	.0068	.001	1.2	5	243	27	4.41	.0066	10.95	6.10	11.78	0
Götl. 436	54	B	C10	C4	C4	D	8.0	1.68	-4.4	.098	.08	.0062	-.062	5	5	206	30	4.28	.0085	10.16	7.47	11.10	3.9
Götl. 436 (INV)	55	B	C10	C5	C5	D	8.1	1.76	-6.1	.101	.57	.0080	-.095	8	6	239	31	4.31	.0088	11.60	6.63	13.00	4.8
Götl. 532 (INV)	56	B	C10	C5	C5	A	8.3	.73	-6.1	.101	.57	.0080	-.095	2.9	14	202	10	4.37	.0088	11.60	6.63	13.00	4.8
Clark Y	57	B	C10	C4	C4	D	8.4	1.68	-5.0	.092	.12	.0083	-.069	1.1	4	202	29	4.07	.0085	10.53	8.30	11.70	3.9
Clark Y (INV)	58	B	C10	C4	C4	D	8.4	.92	-5.0	.098	.35	.0072	-.072	1.7	3	158	16	3.96	.0096	10.00	8.26	11.46	3.3
Clark Y-B	59	B	C10	D4	D4	D	8.2	1.14	-5.2	.089	.10	.0091	-.075	1.3	2	187	30	4.14	.0083	13.51	10.63	15.00	3.0
Clark Y-M-15	60	B	D10	E4	E4	D	8.0	1.23	-5.1	.091	.07	.0104	-.071	1.3	1	154	18	4.24	.0104	16.21	12.72	18.00	4.0
Clark Y-M-15 (INV)	61	C	E10	E4	E4	A	8.2	1.39	-5.1	.091	.07	.0104	-.065	2.2	2	154	30	4.04	.0104	16.21	12.72	18.00	4.0
Clark Y-M-18	62	C	E10	E4	E4	A	8.3	1.39	-5.1	.091	.07	.0104	-.065	2.2	2	154	18	4.04	.0104	16.21	12.72	18.00	4.0
Clark Y-M-18 (INV)	63	C	E10	E4	E4	A	8.3	1.39	-5.1	.091	.07	.0104	-.065	2.2	2	154	30	4.04	.0104	16.21	12.72	18.00	4.0
Clark Y-6	64	B	A10	B3	B3	D	8.1	1.07	-2.9	.098	.15	.0059	-.038	7	5	181	37	4.28	.0092	5.40	4.24	6.00	1.9
Clark Y-8	65	B	B10	B3	B3	D	8.0	1.37	-3.6	.096	.14	.0060	-.045	7	6	228	30	4.20	.0092	7.21	5.66	8.00	1.9
Clark Y-10	66	B	B10	C3	C3	D	7.9	1.68	-4.5	.096	.22	.0075	-.059	7	4	224	30	4.28	.0075	9.01	7.08	10.00	3.2
Clark Y-10	67	B	D10	E6	E6	D	8.0	1.72	-6.2	.096	.13	.0080	-.059	1.2	6	191	31	4.20	.0091	12.61	9.93	14.00	4.6
Clark Y-18	68	B	E10	E6	E6	D	8.1	1.48	-7.6	.092	.23	.0117	-.058	1.5	6	126	33	4.07	.0121	16.22	12.74	18.00	6.3
Clark Y-18 (INV)	69	B	E10	E6	E6	D	8.1	.89	-7.6	.088	.23	.0117	-.058	1.5	6	126	33	4.07	.0121	16.22	12.74	18.00	6.3
Clark Y-22	70	B	F10	E8	E8	D	7.9	1.36	-9.3	.088	.15	.0140	-.107	1.8	13	97	34	3.93	.0141	19.82	15.53	22.00	8.0
N.A.C.A.:	71	B	F10	E8	E8	D	7.9	1.36	-9.3	.088	.15	.0140	-.107	1.8	13	97	34	3.93	.0141	19.82	15.53	22.00	8.0
Clark Y-22	72	B	F10	E8	E8	D	8.1	1.58	-2.9	.095	.08	.0076	-.027	7	6	208	28	4.18	.0077	10.53	8.30	11.70	3.1
Clark Y-22	73	B	F10	E8	E8	D	8.1	1.58	-2.9	.095	.08	.0076	-.027	7	6	208	28	4.18	.0077	10.53	8.30	11.70	3.1
Clark Y-22	74	B	F10	E8	E8	D	8.0	1.61	-3	.095	.08	.0077	-.027	7	6	196	26	4.18	.0077	10.29	9.00	12.01	2.4
Clark Y-22	75	B	F10	E8	E8	D	8.2	1.19	-3	.087	.03	.0077	-.027	7	6	196	26	4.24	.0077	10.29	9.00	12.01	2.4
N.A.C.A.:	76	B	F10	E8	E8	D	8.2	1.19	-3	.087	.03	.0077	-.027	7	6	196	26	4.24	.0077	10.29	9.00	12.01	2.4
Clark Y-22	77	B	F10	E8	E8	D	8.2	1.17	-2.0	.094	.15	.0089	-.043	3	0	170	29	4.14	.0071	10.30	8.27	12.00	2.0
Clark Y-22	78	B	F10	E8	E8	D	8.4	1.64	-2.1	.095	.17	.0089	-.045	7	3	228	28	4.18	.0071	10.45	8.27	12.00	2.0
Clark Y-22	79	B	F10	E8	E8	D	8.1	1.69	-1.9	.095	.25	.0071	-.047	4	0	235	29	4.20	.0074	10.45	8.27	12.00	2.6
Clark Y-22	80	B	F10	E8	E8	D	8.2	1.02	-2.2	.093	.17	.0065	-.044	0	3	155	33	4.11	.0068	9.83	8.27	12.00	2.0
Clark Y-22	81	B	F10	E8	E8	D	8.1	1.02	-2.2	.093	.24	.0065	-.048	1.2	3	157	33	4.00	.0078	9.70	8.27	12.00	2.0
Clark Y-22	82	B	F10	E8	E8	D	8.1	1.71	-2.1	.096	.20	.0074	-.038	4	1	231	28	4.20	.0077	10.29	8.96	12.00	2.4
Clark Y-22	83	B	F10	E8	E8	D	8.1	1.68	-2.1	.097	.20	.0074	-.040	4	1	231	28	4.24	.0077	10.29	8.96	12.00	2.4
Clark Y-22	84	B	F10	E8	E8	D	8.0	1.65	-1.0	.100	.18	.0082	-.007	5	7	266	27	4.34	.0094	8.40	4.67	9.00	2.0
Clark Y-22	85	B	F10	E8	E8	D	8.1	1.67	-1.0	.103	.15	.0088	0	-1	6	246	27	4.44	.0070	11.19	6.21	12.00	2.0
Clark Y-22	86	B	F10	E8	E8	D	8.0	1.54	-1.0	.105	.08	.0075	.008	-1	8	205	27	4.51	.0075	13.97	7.79	15.00	2.0
Clark Y-22	87	B	F10	E8	E8	D	8.0	1.46	-1.3	.104	-.05	.0082	.008	-1	8	178	27	4.47	.0082	16.70	9.38	18.00	2.0
Clark Y-22	88	B	F10	E8	E8	D	7.9	1.14	-1.3	.102	.10	.0056	-.010	2	6	204	30	4.41	.0057	5.63	3.10	6.00	2.0
Clark Y-22	89	B	F10	E8	E8	D	8.5	1.64	-1.3	.100	.06	.0072	.001	1.0	5	228	25	4.34	.0073	10.69	8.27	12.00	1.6
Clark Y-22	90	B	F10	E8	E8	D	8.2	1.73	-1.3	.100	.08	.0074	.001	1.3	8	234	25	4.34	.0074	10.71	8.28	12.00	2.1
Clark Y-22	91	B	F10	E8	E8	D	8.0	1.62	-1.2	.100	.08	.0074	-.002	1.3	7	219	25	4.34	.0075	10.73	8.28	12.00	2.4



1 Type of chord. See reference 10.
 2 Type of pressure distribution. See reference 10.
 3 Type of scale effect on maximum lift. A signifies practically no scale effect. For other designations see reference 8, fig. 44.
 4 Type of lift-curve peak as shown in the sketches.
 5 Turbulence factor is 2.64.
 6 These data have been corrected for tip effect.



Positive directions of axes and angles (forces and moments) are shown by arrows

Axis			Moment about axis			Angle		Velocities	
Designation	Symbol	Force (parallel to axis) symbol	Designation	Symbol	Positive direction	Designation	Symbol	Linear (component along axis)	Angular
Longitudinal	X	X	Rolling	L	Y → Z	Roll	ϕ	u	p
Lateral	Y	Y	Pitching	M	Z → X	Pitch	θ	v	q
Normal	Z	Z	Yawing	N	X → Y	Yaw	ψ	w	r

Absolute coefficients of moment

$$C_l = \frac{L}{q b S}$$

(rolling)

$$C_m = \frac{M}{q c S}$$

(pitching)

$$C_n = \frac{N}{q b S}$$

(yawing)

Angle of set of control surface (relative to neutral position), δ . (Indicate surface by proper subscript.)

4. PROPELLER SYMBOLS

D , Diameter
 p , Geometric pitch
 p/D , Pitch ratio
 V' , Inflow velocity
 V_∞ , Slipstream velocity

T , Thrust, absolute coefficient $C_T = \frac{T}{\rho n^3 D^4}$

Q , Torque, absolute coefficient $C_Q = \frac{Q}{\rho n^3 D^4}$

P , Power, absolute coefficient $C_P = \frac{P}{\rho n^3 D^5}$

C_{ps} , Speed-power coefficient $= \sqrt{\frac{\rho V^5}{P n^3}}$

η , Efficiency

n , Revolutions per second, r.p.s.

ϕ , Effective helix angle $= \tan^{-1} \left(\frac{V}{2\pi r n} \right)$

5. NUMERICAL RELATIONS

1 hp. = 76.04 kg-m/s = 550 ft-lb./sec.

1 metric horsepower = 1.0132 hp.

1 m.p.h. = 0.4470 m.p.s.

1 m.p.s. = 2.2369 m.p.h.

1 lb. = 0.4536 kg.

1 kg = 2.2046 lb.

1 mi. = 1,609.35 m = 5,280 ft.

1 m = 3.2808 ft.